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Local Branches of the American Society of Civil Engineers.

At the convention of the American Society of Civil Engineers later in the month one of the subjects to be discussed is the organization of local branches in districts where there are enough members to warrant the step. This project has been talked about for many years, but it never before passed beyond the stage of discussion. In the announcements by the Board of Direction in the May "Proceedings" it is stated that steps have been taken to ascertain the feeling on the subject in fourteen districts and the formation of the branches is recommended. In making this recommendation the Board claims "that associations of this character would be of great advantage to the profession in general, and would widen greatly the influence of this society, and enhance its standing in the various communities; that if coincidentally (or practically so) the papers issued in our 'Proceedings' could be brought up for discussion at meetings in various localities and the resulting discussion forwarded to the secretary of the society for publication, subject to the rules in force in regard to the discussions which now take place in New York, it would result in great advantage to the 'Transactions,' and that, in nearly all cases, it would be possible for the author of a paper published by the Society to be within reasonable traveling distance of some point at which his paper is to be read, and give him an opportunity to present it in person."

This project has much to recommend it. At the present time the only direct return a very large proportion of the members receive from their connection with the Society is to be found in the voluminous and important publications it issues. The indirect advantages of membership in a strong national organization of this nature deserve greater consideration than they usually receive, and if the privilege of attending local meetings is added to them the result will be beneficial, except, possibly, in one respect.

Local engineering organizations are among the most satisfactory means for bringing all engineers in any district together. The organizations in Brooklyn, Cleveland, Chicago, Pittsburg and Philadelphia, which make the civil, mechanical, electrical, chemical and other specialists well acquainted with each other, occupy a special field. In these cities very little is heard about the mutual distrust of one class of specialists for another which is too often noticed in New York. These local organizations give all classes an opportunity to learn something about the difficulties and achievements in the whole broad engineering field. The men become well acquainted and a good engineering feeling is maintained, in distinction from the narrow specialism characteristic of the New York district outside of Brooklyn. The late George S. Morison, in his presidential address before the American Society of Civil Engineers, pointed out this distinctive field of local engineering organizations, and one of the best of them, that at Chicago, was ofen referred to by him as a model of its class.

Any step taken by the American Society of Civil Engineers which will diminish the usefulness of these local organizations must be deplored. The Board of Direction states that the formation of the proposed branches, composed exclusively of its own members, would not interfere with such clubs. This seems to be the case with the numerous branches of the American Institute of Electrical Engineers, which has been the pioneer in such work. It must be acknowledged, however, that electrical engineering is a mystery to most people who do not follow its developments exclusively. Papers on most electrical subjects can only be discussed intelligently by specialists, and branch organizations of such men will in no way interfere with general engineering discussions. It is also possible that in a few cities like Milwaukee, Pittsburg or Philadelphia, branches of the national mechanical engineering society would find enough special subjects to talk about to keep them busy, but as a general proposition it is safe to say that the most useful local organization will be one admitting to its membership anybody interested in any engineering subject. The Boston Society of Civil Engineers owes a large measure of its very marked usefulness to its members who do not belong to the American Society of Civil Engineers. The well-attended meetings of the Brooklyn club gain importance from their broad range of subjects, covering all fields of engineering. The Philadelphia, Pittsburg, Cleveland and Chicago organizations owe their usefulness to the very fact that their membership is not hedged about with so many restrictions as are necessary for a national organization.

So far as this movement for branches of the American Society of Civil Engineers will promote the engineering interests of any district it deserves hearty support. But if it will interfere with the usefulness of organizations of a purely local character, with few qualifications for membership and small dues, where rodmen and draftsmen and ambitious foremen are eligible for admission, the movement must be regarded with disapproval. As a matter of fact it will probably be found that a branch organization will be highly desirable in some places, while in others, where the local organizations of the type so highly praised by Mr. Morison occupy an influential position in the community, maintain their own rooms and have the traditions of a creditable record of many years, the organization of a branch will probably depend more on the good it may do the Society as a whole than on any benefit the members themselves can derive from it.

It is to be hoped that when the subject is discussed the members will have an opportunity of learning the experience of other national organizations which have tried the system. It is usually successful, as in Germany and Great Britain, among organizations with few qualifications for membership, but whether it is justifiable in a district having less than a hundred members to draw on remains to be proved. It should be observed that the attendance at the New York semi-monthly meetings of the American Society of Civil Engineers is very small, averaging about 150 in May, 20 per cent. of whom were visitors. The similar meetings of the mechanical and electrical engineers have a much larger attendance. If the local branches of the civil engineers' society cannot muster a better attendance, in proportion to the total membership in the district, there will be some meetings of barely a baker's dozen. Such meetings are, of course, not worth holding.

The Cantilever Method of Erection for Difficult Bridge Renewals.

For a new span on an unobstructed site the cantilever method of erection, especially for a pin-connected structure, is a comparatively simple matter, the principal difficulties being due to the excessive temporary erection stresses induced in trusses which become free spans after erection, the comparative slowness of the work and the difficulty of accurate adjustment of the last members connected under heavy stresses. Experienced erectors know how to deal successfully with these difficulties and simple cantilever erection has become a standard type of work, and is occasionally modified by auxiliary features, such as temporary reinforcement trussing, for free spans as at the Northfield bridge, backstays for arches as at Niagara, and temporary anchor spans as at Atbara and the Columbia River.

When it is necessary to replace an old railroad span under constant traffic by a new one on the same substructure without interrupting the train service or obstructing navigation, and especially when the load on the old span cannot be much increased, the problem of erection is likely to be particularly difficult. Two such cases, the St. Joseph drawbridge and the Benwood bridge, have recently arisen and the manner in which they were handled is especially interesting as showing the adaptability of the cantilever method to such work.

In the Benwood bridge a long and lofty channel span over a river subject to sudden high floods, was replaced by a new span built outside of it by the cantilever method, without interfering with the train service or materially increasing the stresses in the old structure. Anchorage reactions

were provided for by temporary new steel trusses outside an adjacent span, and by another adjacent permanent span designed for that purpose. Very simple and efficient methods were provided for making the final connections in the center panel and for making the new floor support the track and the old span, and afterwards replacing it for permanent service in a different position. This method as a whole is novel in bridge erection, and recalls the use of auxiliary erection trusses outside the old structure on the renewal of the Victoria bridge at Montreal, and for the International bridge at Buffalo, although these trusses were used as free spans. The erection of the Benwood bridge by any other method would probably have involved the abandonment of the old structure while the work was in progress and a costly provision for bypassing the traffic.

In the case of the erection of the St. Joseph drawbridge, railroad traffic was unobstructed during the renewal of the span, the old span did not sustain any part of the weight of the new one or even of the traveler, and both floor and trusses of the new span encroached on the positions of the old. The new trusses were assembled inside the old; and the latter and the track were carried by them while the old span was removed and the new trusses separated transversely and the floor raised, making complicated operations and tedious work.

Both jobs were executed under the direction of the same engineer and were accomplished with ordinary plant and without any serious accidents. The structures were accurately manufactured and, contrary to the practice abroad, were not assembled before being shipped to the field. Full details of the plant, complete schedules of operations, and instructions with calculated distances to be measured and checked as the work progressed, were prepared in advance and issued to the superintendent, and the work was successfully performed in strict accordance with them without delay or modification of the original plan of construction.

Engineering Mathematics.

The professional work of the engineer, it now matters little in what field, has become so intensely technical that the engineering schools are apparently under stress, at least in some quarters, to make their educational training not less intensely technical. All matters pertaining to the suitable education of engineers are of practical importance, and there is no danger of giving them too much consideration. Every true profession depends chiefly for its advanced character, as well as for the degree of esteem in which it is held by the public, on the excellence of the educational training of its members in professional schools. The professions of law and medicine are now so old that large questions of educational policy can scarcely arise. Engineering, as a "profession," on the other hand, does not enjoy a similar advantage. There are still many open questions regarding engineering education which are tacitly under widespread consideration, if not active discussion, and none more so than the extent to which mathematical studies shall be pursued in a course of professional training for engineers.

There are certain mathematical subjects generally recognized to be essential for every well-balanced course of engineering study, differential and integral calculus standing at the higher limit of the series. It is also recognized that the more technical parts of the last two years of study in an engineering school must inevitably be based upon a thorough course in analytical mechanics. Such a broad or general statement will probably not be questioned as to accuracy or propriety in its main features, but there may be a great difference of opinion as to what should be included under its general terms.

A reasonably full examination of the announcements of a number of the engineering schools of the United States will show among other things that there are quarters where advanced study, for instance, in the theory and use of differential equations is required, and where students are ostensibly taken even into the study and applications of quaternions. It may be admitted at once that there is no purely mathematical knowledge which may not be of some direct use in his career to almost any professional engineer who enjoys even a moderate range of practice in any one of a number of such specialties as the manufacture and use of power, structures, hydraulic work or electrical engineering; but it may be a serious question whether any material amount of time in his professional school would have been wisely applied to such advanced subjects as that named above. The true purpose of a professional school is neither to give excessively advanced training in some particular line for the benefit of a comparatively few specially equipped intellects, nor to degrade itself, on the other hand, to a low level fitted to dull or ill qualified students. It should give well-balanced educational training adapted to develop intellectual strength in a high average of those young men who are naturally well fitted to pursue the profession of engineering with credit to themselves and to the benefit of the entire profession. In such a course of study subjects of a technical character whose intelligent or successful treatment must be based upon a knowledge of mathematics, form the very framework and sustaining elements of the whole educational structure. That fact, however, does not justify the application of the regular student's time to the pursuit of highly advanced study in special fields of mathematics having only rare applications in the technical work of the engineer. There is too little time even to familiarize the student with the theory and use of differential and integral calculus and analytic mechanics of the usual scope. The more thorough and intelligent is a student's comprehension of those subjects and the more familiar is he with their suitable applications to engineering work, the more efficient, self-reliant and forceful will he be in his subsequent career as an engineer. Further, the quality of his judgment trained in practical experience will be immeasurably enhanced by the accuracy and precision of his mathematical knowledge, and his power to use it. As true as that observation is, however, no greater mistake can be made than to attempt to force a student's work in pure mathematics beyond the limits of reasonable application in the engineering field. It is one of the first and most important duties of the engineering educator to guard this balance between abstract science and the real things of engineering.

As a matter of fact, there has already been too much specialization in engineering education, and to such an extent as seriously to endanger the educational value of the engineering school. This tendency would be much aggravated by development of intensely special work in pure mathematics beyond the limits which have been indicated as reasonable and effective by experience both in the classroom and in the office. What is imperatively needed is a clearer and more comprehensive knowledge of mathematical subjects in their relations to the actual technical work of the engineer, rather than the extension of abstract study beyond the region of useful application.

These observations lead to others closely allied to them, although of somewhat different nature. The old method of "recitations" on pure theory or even general principles of mathematical and engineering subjects has been shown for many years to be out of place in the classroom, and on the other hand, the pure lecture system for instruction in an engineering school is probably about the most ineffective and time-wasting for the student ever devised, although probably the easiest for an unprogressive instructor. Another species of dry rot which has set in to a fatal extent with some instructors, although it is to be hoped not with many, is the system of descriptive lecturing. This consists chiefly in the description of engineering plants and processes frequently accompanied by the seductive lantern slide. Little or no analytical or exact information is or can be given in the classroom by such a method, any approach even to such efficient instruction work as exact demonstrations or actual design work being absolutely excluded. These classroom exercises are mere pictorial seances between the instructor and his classes where the conveying of anything more than a superficial or popular impression is impossible. What is needed, and imperatively needed, in the classroom of the professional engineering school is sound instruction in what may be termed the philosophy of engineering. Above all other things general principles should be thoroughly taught so as to give the students complete command of their useful applications in those problems of design, construction and operation which are constantly met in engineering practice. Such instruction would arouse the interest of the student, give him confidence and self-reliance in his work and develop the power to use the results of his educational training with the highest degree of efficiency.

The Lightning Rod.

It is interesting to observe the progress of the lightning rod in the favor of men competent to judge of its merits. Years ago it was the bane of the land, and the lightning-rod agent was as little favored as the hobo of to-day. Very likely there was a good reason for this, for he certainly was the Baron Munchausen of applied electricity, yet it is apparent that some of the things that he did without other reason than to sell plenty of his twisted rods are now looked upon with favor by those who have studied the protection of structures from lightning. The disfavor of the lightning rod is certainly diminishing, and recently the National Fire Protection Association in this country and the Lightning Research Committee in Great Britain have been paying much attention to the subject.

Fortunately, it is now possible to understand why destruction formerly occurred in structures well equipped with rods properly installed. These cases, which were largely the cause of the lack of confidence shown in such protection, we now know to be due to an unusual form of lightning, and on account of the general growth of interest in the subject, it is timely to mention the new theory of these discharges. Some years ago it was pointed out by Sir Oliver Lodge and others that lightning was of two classes, which that physicist named the A and B flashes, respectively. The A flash, as explained in the recent report of the Lightning Research Committee, is of the simple type that arises when an electrically-charged cloud approaches the surface of the earth without an intermediate cloud intervening. Under these conditions the ordinary type of lightning conductor acts in two ways: first, by silent discharge, and second, by absorbing the energy of a disruptive discharge. In the second class, B, where another cloud intervenes between the cloud carrying the primary charge and the earth, the two clouds practically form a condenser. When a discharge from the first takes place into the second, the free charge on the earth side of the lower cloud is suddenly relieved, and the disruptive discharge from the latter to the earth takes such an erratic course

that no series of lightning conductors of the hitherto recognized type suffice to protect the building.

The reason for this latter statement can be best explained by pointing out the change in the opinions held concerning the character of lightning discharges. Formerly, as Dr. Lodge recently pointed out, electricity was treated as if it had no inertia and all that was necessary was to get it from the clouds to earth as quickly and easily as possible by the shortest path. It is now recognized, however, that it is not so much the quantity of electricity that has to be attended to as the electrical energy. The problem is to dissipate as quietly as possible this electrical energy stored between the clouds and the earth in dangerous amounts. A sudden dissipation of energy is always violent, and nobody in his senses tries to stop a heavy flywheel or a railway train suddenly. It is exactly the same with the store of energy beneath an electrified cloud or between one cloud and another. A perfect conductor, if struck, would deal with the energy in such a rapid manner that the result would be equivalent to an explosion. Hence the conductors must be of moderately high resistance. In any case, however, the rush is likely to be rather violent, and, like an avalanche, it will not take the easiest path provided for it. No one path artificially provided can be said to protect others, and the only safe protection is the impracticable one of encasing the building wholly in metal.

This statement explains why the points of conductors are sometimes inoperative in protecting a structure. When the energy is stored between cloud and cloud, instead of between cloud and earth, and the initial discharge is from one cloud to another, the lower cloud is liable to overflow suddenly to the earth through a region where there has been no previous preparation, and where any number of points or a rainshower or any other means for a gentle leak would be quite inoperative. A violent discharge can then occur at the sharpest point, and in this connection it should be observed that a column of heated air like that rising in a chimney is even preferred by the lightning to an ordinary conductor. These considerations have led the British committee to make the following practical suggestions concerning protection against lightning: Two main lightning rods, one on each side, should be provided, extending from the top of each tower, spire or high chimney by the most direct course to earth. Horizontal conductors should connect all the vertical rods (a) along the ridge or any other suitable position on the roof, and (b) at or near the ground line. The upper horizontal conductor should be fitted with aigrettes or points at intervals of 20 to 30 ft. Short vertical rods should be erected along minor pinnacles and connected with the upper horizontal conductor. All roof metals, such as finials, ridging, rainwater and ventilating pipes, metal cowls, lead flashing, gutters and the like, should be connected to the horizontal conductors. All large masses of metal in the building should be connected to earth either directly or by means of the lower horizontal conductor. Where roofs are partially or wholly metal-lined, they should be connected to earth by means of vertical rods at several points. Gas pipes should be kept as far away as possible from the positions occupied by lightning conductors, and as an additional protection the service mains to the gas meter should have a metallic connection with house service leading from the meter.

These suggestions are much less minute in their details than those recently made by the committee of the National Fire Protection Association, but it is not unlikely that they are about as useful in actual practice. They omit one suggestion that is strongly urged in this country by several investigators of lightning phenomena, and that is the provision of points and conductors on large trees in the vicinity of buildings. This provision, which seems to have originated in a suggestion made by Prof. Elihu Thomson, is a very good one for some cases. The most important feature of the work being done on both sides of the Atlantic is, however, the careful investigation of cases of damage by lightning and the examination by men of high standing among electrical engineers of the data thus acquired. This work will eventually result in lifting the ban imposed by the public on the lightning rod and will add somewhat to the safety of buildings and high chimneys against a class of accidents which are commonly classed as unpreventable.

Notes and Comments.

SEWAGE SLUDGE is being treated experimentally at Bradford, England, under the direction of Dr. J. Grossman, to determine definitely whether any commercial fats can be recovered from it. The plant has a capacity of about 16 tons of sludge daily and is said to work without objectionable odor. It yields about 7 tons of manurial residue daily "containing besides free carbon 2 per cent. of nitrogen and 2½ per cent. of phosphate of lime." The distillation process is used and the value of the residue and the grease recovered is said to be greater than the working expenses.

MIXTURES OF LIME AND CEMENT seem to be arousing considerable interest in various quarters at present and by way of answer to a number of inquiries it may be pointed out that Mr. L. C. Sabin gives some useful data in his invaluable "Cement and Concrete." After explaining numerous tests he reaches the conclusion that the addition of 10 to 20 per cent. of slaked lime to cement mortars containing as much as three parts of sand, not only renders them more plastic, but actually increases the tensile strength, especially if the mortars are kept damp during hardening. The tests also indicate that for mortars exposed to the open air the lime should be in the form of slaked and sifted powder rather than paste.

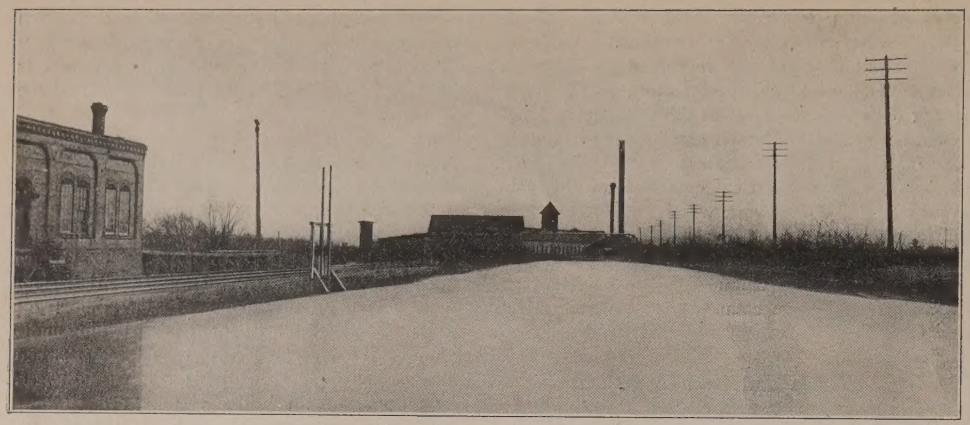
THE EFFECT OF THE STAINES RESERVOIR of the London water-works in keeping down color and organic impurity during the floods in the Thames in March are well shown in a report by Dr. T. E. Thorpe. The raw river water was exceedingly turbid and contained a very large proportion of soluble organic impurity, while the Staines stored water was almost clear and contained less than half the amount of organic matter in the raw river water. In the case of the Grand Junction works in particular it is quite certain that the Staines water was of great assistance in keeping down the color and the proportion of organic impurity in the supply. The reservoir was fully described and its unusual purpose explained in this journal on Nov. 28, 1903.

FLUE-GAS ANALYSIS was strongly recommended in the report of the committee on fuel economies at the recent meeting of the Ohio Gas Light Association. The committee pointed out that probably nowhere can a little knowledge of chemistry be made use of to a better advantage than it can be in an endeavor to obtain proper combustion of fuels. The apparatus necessary for doing this work is so inexpensive and its operation so simple that no works can afford to operate without its use. Large amounts of money are invested to obtain the highest efficiency types of apparatus in the way of furnaces, economizers and recuperators, and after the installations are made too often no attention is ever given to find out what results are being obtained, and many of the so-called economizers on the market depend to a very large extent upon utilizing the needless and careless waste in fuel going on in the furnaces, and which can just as well, and better, be saved in the setting as in an expensive addition to it, for there is bound to be economy in the centralization of the process.

THE THEBES BRIDGE, which is now practically complete, was described in this journal on Nov. 2 and Dec. 24, 1904. Its structural features are naturally very interesting, for Messrs. Noble and Modjeski brought to its design the experience gained on many large structures in the Mississippi valley. From another point of view the structure is of equal interest, for it is a striking indication of the growth of direct business between Chicago and points in the distant Southwest. The purpose of the bridge is to afford an outlet for this traffic which will be free from terminal charges at St. Louis, and the fact that the route over the bridge is some miles shorter than that via St. Louis, is an additional point in its favor. Consequently whether the bridge is considered as an engineering achievement or a new link in the country's transportation system, it fully deserves the attention it is now receiving.

SOCIETY COMMERCIALISM is having a rough time just now in the British technical press. It is pretty well understood that no technical organization in that country should receive papers which are confined exclusively to a direct exposition of the merits of any patented apparatus or process. A large amount of valuable data relating to proprietary devices is to be found in society publications, but it is presented in a manner which makes the information of real use. Recently, however, one of the British engineering organizations in some way allowed an agent of an office furniture firm to read a paper before it on card indexing and filing. Evidently the society was worked to the limit of an enterprising publicity seeker, for when he caused the paper to be reprinted for distribution by his firm as a trade publication, the indignation of the British technical public boiled over in contributions to many journals. This action is a very good one. The proceedings of technical societies must be absolutely free from any direct commercialism or they will lose a great measure of their influence. There is not the slightest objection to describing patented apparatus if it is done in the right spirit, but no society should let its meetings become auctions.

A UNIQUE GARAGE and clubhouse will be erected at Eighth Ave. and West 54th St., New York, by the Automobile Club of America. It will have a 131-ft. frontage, a depth of 87 ft., and an 80 x 13-ft. extension. There will be a basement and six stories. In the basement will be a turbo-generator plant with storage battery for lighting and power service, boilers, coal and gasoline storage. The ground floor will accommodate 50 cars, and also provide washing stands, offices and a large lobby. A grand staircase will lead to the second floor, which will have the usual club appointments. On the floor above there will be a billiard room, sleeping rooms, quarters for chauffeurs, and some storage space for cars. The next two floors will also serve for cars, while the top floor will be a repair shop. Two electric elevators of 4 tons capacity will be used for the cars. The machine shop is to be equipped for any kind of repairs and will be under the charge of an expert in such work. It will contain a specially designed dynamometer, for use in careful tests of different types of car. The structure will be of reinforced concrete and contain many special fire-protective features. It has been designed by Mr. Ernest Flagg, under the direction of a building committee consisting of Dr. Schuyler Skaats Wheeler, chairman, Mr. Colgate Hoyt, Gen. George M. Smith and Mr. A. R. Shattuck.



Canal of Water Power Co.; Hennepin Pulp and Paper Mills in the Distance.

WATER POWER DEVELOPMENT AT LITTLE FALLS, MINN., AND ITS INDUSTRIAL RESULTS.

By Arthur Warren.

Those who have not watched the growth of a Western settlement can have no conception of its rapidity, combined with solidity. Chicago, Milwaukee, St. Paul and Minneapolis have all sprung up within the memory of living men. The great falls at St. Anthony checked for a moment the influx of population up the Mississippi River and formed the nucleus for the Twin Cities, which now boast a population of something like 500,000. The people turned the big Falls of St. Anthony to account, set new industries going with it, and pushed on. Ninety miles north of Minneapolis is the city of Little Falls. Here again the forward movement paused for a time and a hamlet grew. From a settlement of 500 persons the town doubled in size in a year after the completion of the dam, and its growth has since been rapid. To-day the city of Little Falls has a poulation of 7,500 and the new buildings, whether dwellings, stores, churches, schools or county buildings are of handsome design and substantial construction. Thanks to the cheap power available from the falls, the town already has an excellent lighting system and water supply.

Little Falls is the county seat of Morrison County and the metropolis of a thriving agricultural community. It is on the main line of the Northern Pacific Railroad with a branch line connecting it with the Great Northern Railroad at Sauk Center, Minn., in the direct line which other railroads must traverse to reach out to the great Northwest. A large hospital and orphanage conducted by the Sisters of St. Francis is a conspicuous feature of the town. Patients for the hospital come to it from many miles around. The town has three banks, churches of every denomination, a handsome court house and good hotels. The Pine Tree Lumber Co. has a large mill on the river bank, where something like 600 men are employed and nearly 100 million feet of lumber are produced each season.

Little Falls is imbued with the Western spirit of push and progress. It has a local board whose chief concern is to encourage the acquisition of new industries. The work of the board is supplemented by the liberality of the Water Power Co., which offers sites for factories free on long-term leases, and power at attractive prices.

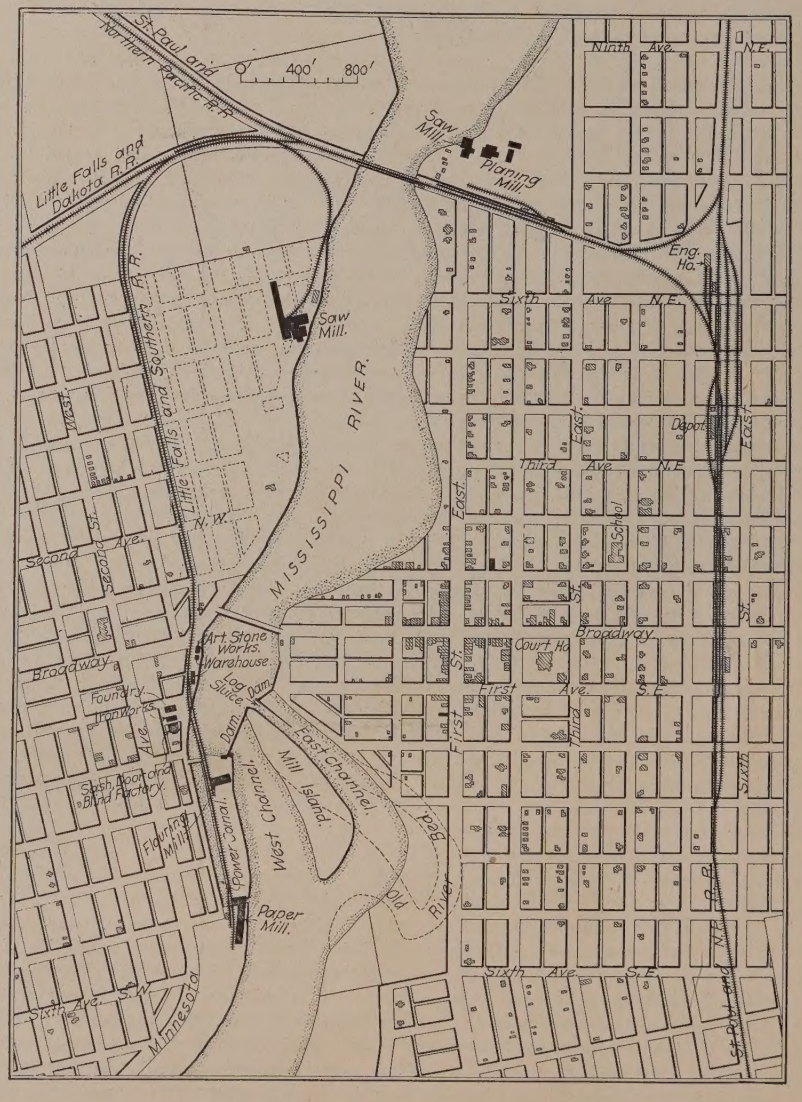
It would be difficult to conceive of a location for a water power more ideal in its character than that of Little Falls. The value of a water power is measured by its regularity of flow and the ease with which it can be dammed and regulated. Without regulation its value could not exceed that of the power to be got from the minimum flow. Many streams with an abundance of water at some time during the year are worthless as water powers because they run dry at other seasons, and there are no means available for storage.

Minnesota, as its name indicates, is literally a land of waters. All the upper part of the State over the vast area that supplies the stream that runs by Little Falls is so covered with lakes, big and small, that one wonders that land enough is left to go around their edges; in the wet season the rims disappear and the whole country is under water. To hold back these mighty waters the Government has designed and built an important series of dams.

The lumbermen, with their numerous influences in national and State capitols, secured the Government appropriations with which these dams were built. The work was done ostensibly to aid "navigation," but in reality to enable the lumbermen to float down their logs during periods of low water. In this system the lumbermen have left a most valuable legacy to the people of the Northwest and to the Little Falls Water Power Co. in particular. To this company it means that a water power which is capable of producing a minimum of 10,000 h.p., with the natural flow of the river can be safely depended upon to produce at least a third more. This amount can then be raised to nearly 17,000 h.p. by adding another 5 ft. to the height of the dam, for which undertaking the company already has authority.

Control of the stored waters is under the authority of the Secretary of War. The needs of the Mississippi water powers have already been recognized and they will soon become paramount in this matter with the waning in importance of the upper Mississippi lumbering industry.

Storage System.—The water storage system which is now to become such a valuable factor in the development of the water power of the Mississippi was inaugurated in 1880 by an appropriation made by Congress. The scheme embraced the building of 41 reservoirs in Minnesota and Wisconsin. Of these reservoirs five have been



Map of Central Portion of Little Falls, Minn.

built, all within the drainage area that furnishes water to the Mississippi above Little Falls. This drainage area comprises about 12,000 square miles, over which the average rainfall is about 25 in.

The work was begun at Lake Winnibigoshish in 1883, where a dam was completed during the following year that furnishes storage space for 45,800,000,000 cu. ft. of water. At about the same time dams were built at Leech Lake and Pokegama Falls, which added storage capacities respectively of 30,000,000,000 cu. ft. and 4,700,000,000 cu. ft. These were followed by the building of the Pine River dam in 1886, holding 7,500,000,000 cu. ft. of water and the Sandy Lake dam in 1895 holding 3,000,000,000 cu. ft. of water. Government statistics show that there have been actually stored in these basins the following amounts:

	Cubic feet.
Lake Winnibigoshish, July, 1886	21,300,000,000
Lake Leech, June, 1896	18,900,000,000
Pine River, June, 1896	5,700,000,000

and the full capacity of each of the others every year. This makes a total of 53,600,000,000 cu. ft. of water held in leash. The value of this to the Little Falls Water Power Co. is obvious.

Government gaugings taken at St. Paul during the low water periods show that the water released from Pokegama Falls reservoir reached St. Paul in seven or eight days and raised the level of the river from 1 to 1½ ft. A rise of the river from the unusually low measurement of 0.77 to 1.77 ft. gauge means an increase of flow from 3,230 to 4,604 cu. ft. a second. The rise from the 2-ft. to the 3-ft. mark gives an increase from 4,452 to 6,596 cu. ft. per second. This additional amount of water falling over a 20-ft. dam would develop 4,872 gross horse-power or something like 3,650 horse-power that could be utilized.

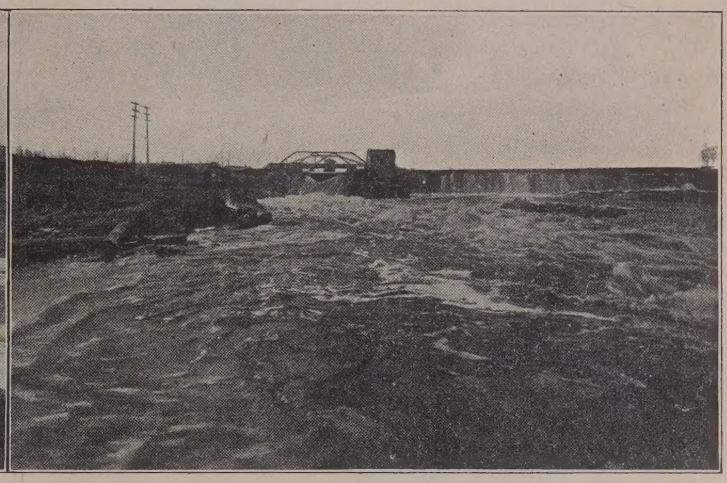
The figures given in the annual reports of the Chief of Engineers make it safe to assert that the system of dams already established at the sources of the Mississippi make it possible to readily keep the minimum flow of the river at Little Falls 3,500 h.p. above the natural minimum with the dam at its present height. Raising the dam 5 ft. would make this amount 4,375 h.p. and would add at the same time 2,500 h.p. to the natural minimum of 10,000 h.p. This is a most important feature of value to the Little Falls Water Power Co. It means that it is safe to calculate all the year around upon a power development of 13,500 h.p. from the present dam, or 16,875 h.p. if the dam were raised.

Natural Power Advantages.—Besides the advantages already described and the natural fall in the Mississippi, Little Falls has a most remarkable advantage over every place on the upper river for a water power site because of the enduring character of the rock.

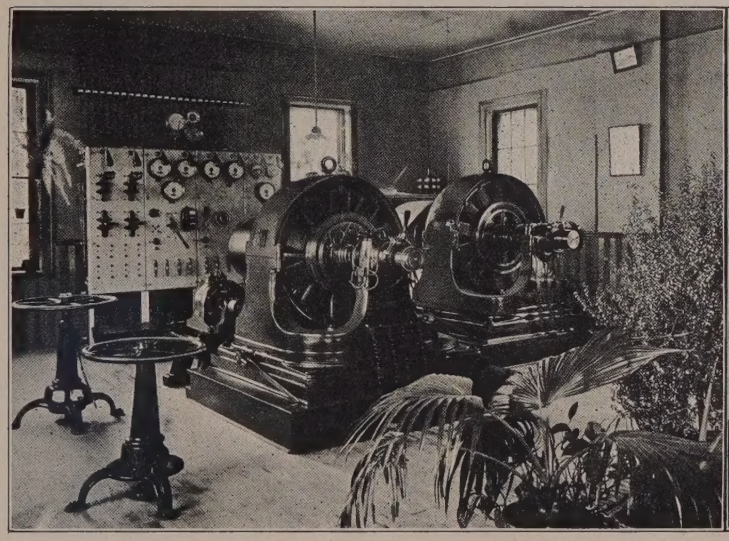
Elsewhere the bed of the Mississippi is notoriously unsafe for the building of dams. Even at Minneapolis, where the existence of the St. Anthony Falls announced that the rocky bed of the river was less subject to wear than usual, the falls began to recede rapidly a few years ago, and to preserve the water power the whole bed of the river was covered with a timber apron costing more than a million dollars. Even now no responsible engineer would guarantee that this protection will be effective for long.

If one examines the pretty little valley of the Minnehaha (Laughing Waters), which lies within the city limits of Minneapolis, they may see almost at a glance where the trouble lies. The disclosed rock on each side of the stream is either friable, soluble limestone, which breaks up rapidly under the influence of water or frost, or a sandstone which is even less reliable. The sandstone consists of fine, rounded, water-worn particles of clear quartz cemented together so weakly that one may scrape the rock to pieces with his thumbnail. The face of the rock weathers to almost a granite color, but the sand is almost as white as snow.

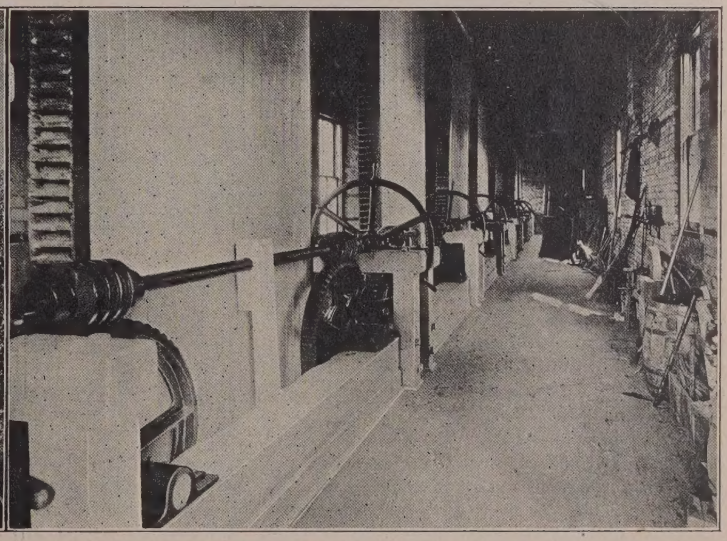
View across River at Dams from West Bank.



View of Log Chute and East Channel Dam.



Interior View of Power House.



Interior View of Gate House.

The Minnehaha cut a valley for almost a mile back from the Mississippi before it found a bar of harder material over which to fall.

Between Minneapolis and Little Falls there are two places where there is fall enough in the river to make water powers, but throughout the whole distance there is not a spot where the treacherous limestone, sand or sandstone does not form the river bed. This bed is treacherous and porous. It is a well-known fact that it leaks so freely that there is often as much water going over the falls at Little Falls as there is running past St. Paul, a hundred miles below. These leaks feed the flowing artesian wells, of which Minneapolis has many.

At Little Falls the character of the rock changes completely. Here a bar of solid, hard, close, slate

rock reaches clear across the river and valley. This lies in nearly vertical strata and is as hard as granite. At a short distance below the dam it is succeeded by a granitic formation. It was this bar of hard rock which formed the falls. In breaking through it the river was divided, leaving in mid-stream an island formed of the same indurated slate.

The eastern bank of the river is about 25 ft. above the river level and the western bank about 20 ft. above that level. The island has an altitude of about 30 ft.

The Dam.—The present available fall from the cap of the dam is 21 ft. The dam is thrown across the river at the head of the island. It is in two parts, each about 300 ft. in length. The dam is built of timber cribwork, held in place by great iron bolts wedged into the rock in holes 20 in. deep. It is filled with coarse rock and gravel. The crib is built of timbers 12 in. square, notched and bolted together at every 7 ft. of their length.

The cribs have a 56-ft. base where the dam is deepest. To protect the dam from water pressure and the impact of logs or other floating materials, an embankment of broken rock 50 to 80 ft. wide has been built against the upstream side. Next to the island on the eastern side is the necessary log chute. This is 32 ft. wide at the top and 110 ft. long. It is built of timber and lined on the bottom and sides with steel plate. Six hundred million feet of lumber pass through the chute each season.

It is a remarkable fact that apparently because of the configuration of the river banks above the dam no precautions are necessary against a destructive flow of ice in the winter. The ice forms heavily in the river, but instead of breaking loose and flowing down the stream in great masses, making it difficult to prevent its carrying all before it, the ice here remains anchored to the shores and gradually wears away on the edge next to the dam. Winter photographs show this curious phenomenon plainly. These show a great bow-like gap of clear water between the dam and the edge of the ice. This gap gradually widens as the winter weather gives away. This condition extends to a considerable distance above Little Falls, and the county bridge has never been endangered by ice. Little if any anchor ice ever forms. In the last three years only six hours of trouble have been experienced from this source.

The Canal.—For the utilization of the water power a canal 1,000 ft. long has been excavated parallel with the river on the west bank and just far enough away from the river to leave room for a line of factories and railroad tracks. The canal is 80 ft. wide and 13 ft. deep. The whole lower portion of the canal lies in solid rock. The waste weir was cut through the lining rock for almost its entire depth. This rock underlies the whole strip of land reserved for factory sites, making secure foundations, and all the sluices and wheel pits are also in solid rock.

Gate House.—Across the head of the canal is the gate house. This stands on a sub-structure 110 ft. long, 17 ft. wide and 21 ft. deep, built of dressed granite blocks resting on the native rock. There are eight gateways, each 6 ft. wide by 10 ft. high, with arched tops. These are provided with substantial gates actuated by approved modern apparatus.

Power Station.—The present plant consists of one 54-in. and one 48-in. water-turbine driving alternating-current generators of a combined capacity of 420 kw. and a 32-in. wheel driving two pumps of a capacity of 2,250,000 gal. per day. The wheels are all vertical and are geared to a horizontal countershaft from which the generators and pumps are driven by belts. A new power house is to be built this summer in which the present apparatus will be rearranged, and much new apparatus installed. This structure will extend from the present structure right across the canal, and its wheel pits will connect with the waste weir now in use. The plant now has a capacity of about 1,000 h.p. The new building will more than double this.

Industries.—The town of Little Falls is one of the most important customers of the Water Power Co. It buys its electric light and its water for fire and domestic purposes from the company. These are furnished under special charters obtained originally by others, but which have come into the possession of the Water Power Co. by purchase. That the services rendered under these franchises are profitable to the company is evident from its annual statements, and that the service is satisfactory to the people is proved by the extent of the business. Hardly a store or dwelling in the town but has in it water and electric light, while it is not uncommon to find electric lights in use even in outbuildings. In fact, there are barns in the country two miles from the center of the town which are lighted by electricity.

Along the canal there are already located two flour mills and a large pulp and paper mill, all taking power from the Water Co. The factory of the Grand Grip Horse Shoe Co. is also about to move there from Duluth. The two flour mills stand on either side of the canal near the intake. The larger one, that of the Minnesota Milling Co., which has a capacity of 800 barrels per day. stands between the canal and the river. It has its own water gates, and the flume and water wheel are within the mill site on the river bank.

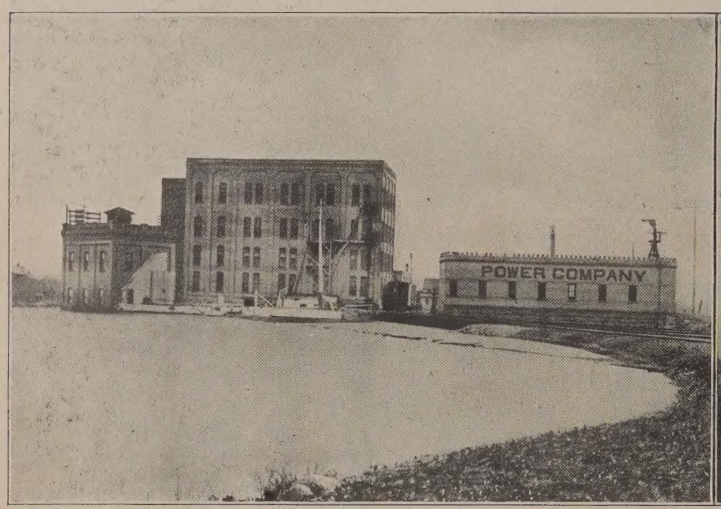
The Little Falls Milling Co.'s mill producing 150 barrels per day, stands on the other side of the canal, and its power is transmitted from the turbine by an overhead cable system.

Near the foot of the canal stands the Hennepin Paper Co.'s mill. Here many cords of spruce are ground up daily and turned into paper pulp. Part of this pulp is worked up directly into paper of the kind used for newspapers. About 20 tons of finished "news" are turned out daily. This mill not only uses a considerable amount of water for power, but also a large quantity directly in the operation of paper making.

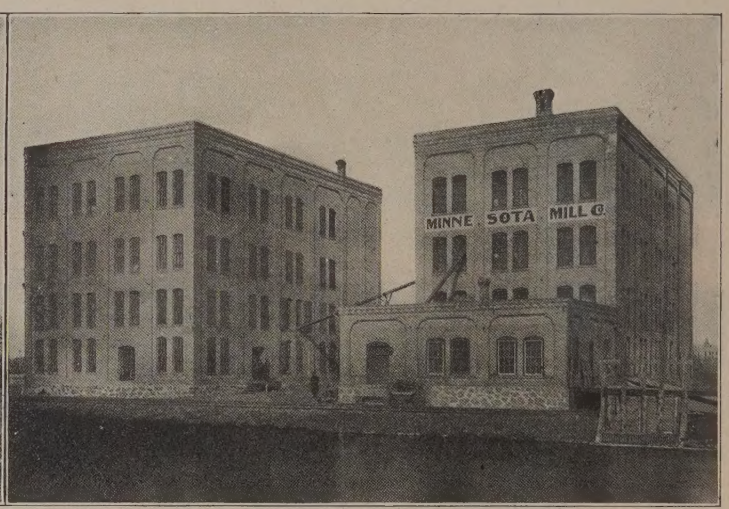
The Little Falls Water Power Co. is now selling or using a total of 2,250 h.p. There is still room for many more mills or factories between the canal and the river, and room for still more on the opposite side of the canal, where power could be supplied either by cable or electricity.

There is, however, another possible source of demand that would easily absorb every surplus foot-pound of energy that Little Falls could produce. This is Minneapolis. Years ago the entire water power of the upper falls at Minneapolis was taken up by the Washburn-Crosby flour mill combination, and since then the Twin City Railway Co. has not only absorbed all the 10,000 h.p. of the lower falls for operating street cars in Minneapolis and St. Paul, but they have erected a great steam power house where three Allis-Chalmers steam engines, each of 5,500 h.p., are already installed, driving electric generators, while room is provided for more than double this power. Already Minneapolis is reaching out to the surrounding territory for more water power, and arrangements are on foot for transmitting this by electricity from many miles away. Modern transmission methods are so far perfected that power could be economically sent over the 90 miles from Little Falls to Minneapolis.

The minimum power of the river at Little Falls is 10,000 h.p. With the addition of 5 ft. to the height of the dam, for which the company has authority, and the proper regulation of the flow from the storage dams in the upper valleys, this could be easily raised to a minimum of about 17,000 h.p. Assuming that local industries will within a year or two require 5,000 h.p. this would leave 12,000 h.p. for the use of Minneapolis. Whether or not this disposition is made of the surplus power, the Little Falls Water Power Co. has ample facilities for taking care of all the factories that may come to it for cheap power in the next few years. Besides the mill sites between the canal and the river provision has been made for a 1,000-ft. extension of the canal to the south



Head of Canal, with Gate House, Mill and Power House.



Flour Mill on Canal of Water Power Company.

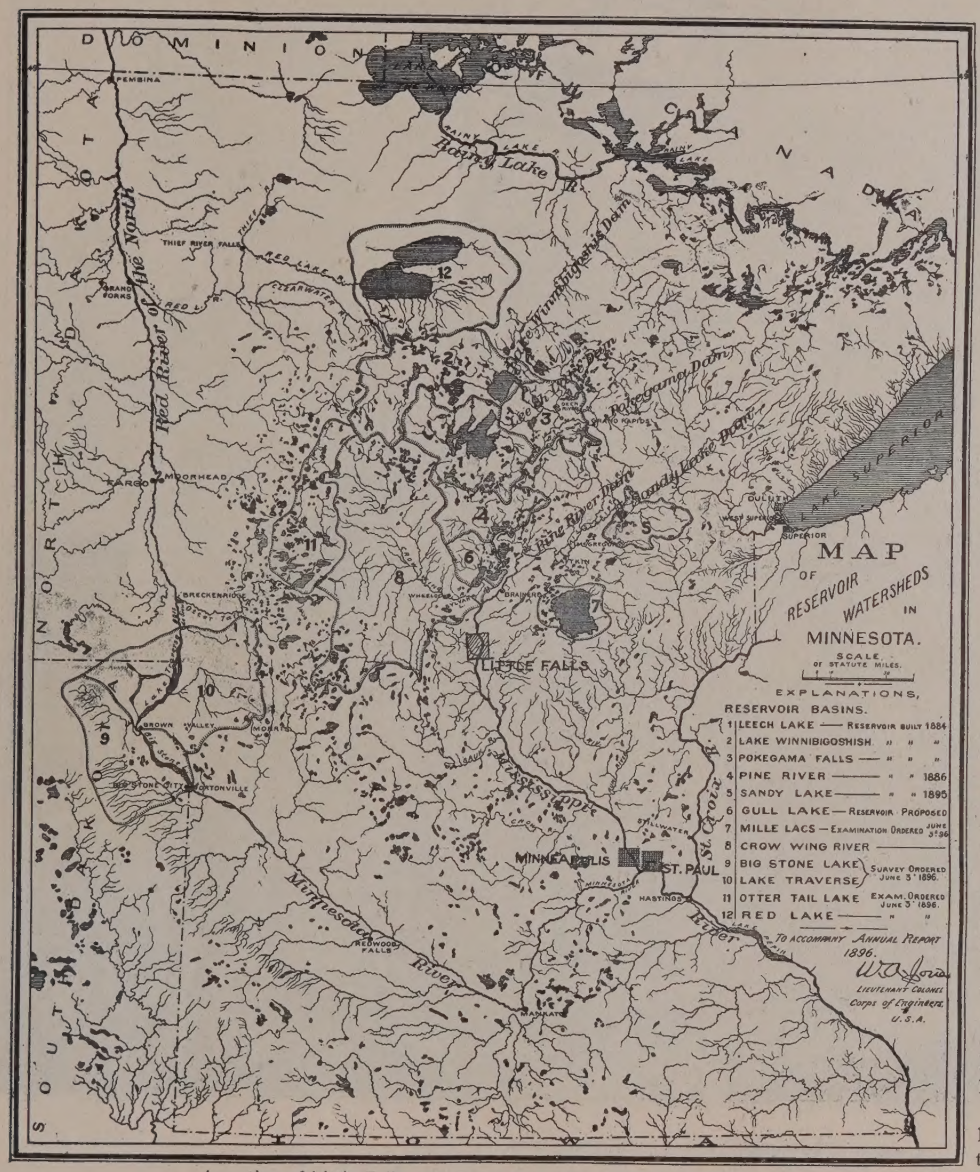
whenever necessary, and the land for this belongs to the company. The company also owns a tract of land to the westward aggregating about 1,000 acres in area. A wide strip of this on the west side of the canal is reserved for mills and warehouses. This strip has a street on one side and railroad tracks on the other. From there the land is laid out in building lots, and many houses have already been erected.

Little Falls Water Power Co.—The Little Falls Water Power Co. was incorporated under the laws of Minnesota on February 14, 1884. Its authorized capital stock is $1,000,000, of which $607,500 is paid in. It has outstanding $331,000 of 5 per cent. bonds. It has a surplus of $46,000. Besides the erection of the dam and its appurtenances, which cost $237,109, and the purchase of real estate valued at $518,663, the company has acquired the rights, property and franchises of two concerns organized respectively for lighting the town and supplying water. The plants for these purposes form assets valued at $215,207 without counting current supplies. The company owns a three-story brick flour milling building on its property, 60x90 ft. in size, valued at $20,000, and dividend paying stock in the House Building Co., which has erected 23 houses on its tract of land. Its total assets are $1,026,858.65. Its last annual statement showed total receipts of $40,888.13 for the year, of which $26,940.65 was net earnings and $8,894.14 surplus. Its receipts for incandescent and arc lighting were $21,875.94, from water rentals $9,988.01, and $7,574.40 from water power leases.

One interesting service of the company is thawing out frozen water pipes in the winter. This is done with electricity. The company has a set of transformers mounted in a wagon. This is driven to wherever a frozen water pipe is to be treated. Current is taken from the overhead service wires; one wire from the wagon is connected to the nearest street hydrant, the other to a cock or faucet in the house to which the frozen pipe belongs. In about ten minutes ordinarily the pipe is freed from ice. The charge is $2.50.

All the lighting in the town is done with a two-phase, 60-cycle, 2,000-volt, alternating current.

The company was chartered by an act of Congress approved July 3, 1886. The act grants to the company the right to improve the water power at Little Falls, and to construct and operate in the river dams, piers, sluiceways, canals, locks, ponds, breakwater abutments and mill sites for manufacturing purposes, providing it maintains a proper sluice for logs, and passes them through free and without any undue delay. In order to make sure of all the rights granted, and to have absolute control of the river, and all rights of access to it, the company bought a strip of land 1 ft. wide on the margin of the river on both sides for half a mile each way north and south of the dam acquiring with it all the riparian rights.



Location of Little Falls with Respect to Minnesota Watersheds.

The Sixty-Ninth Regiment Armory Drill Hall, New York.

The Sixty-ninth Regiment Armory is a 197½x 305-ft. brick and steel building, with street fronts on Lexington Ave., 25th and 26th Sts., New York. The company rooms, reception rooms and most of the other rooms for the use of the regiment are contained in the four-story and basement end portion of the building, which is constructed with steel floor and roof beams and girders supported on interior and exterior brick walls. At the opposite end of the building there is a small four-story hospital wing isolated from the other rooms, and between this wing and the front of the building there is a drill hall 201 ft. 11½ in. long and about 188 ft. 10 in. wide, with brick gable walls and a roof and upper side walls supported by long-span trusses.

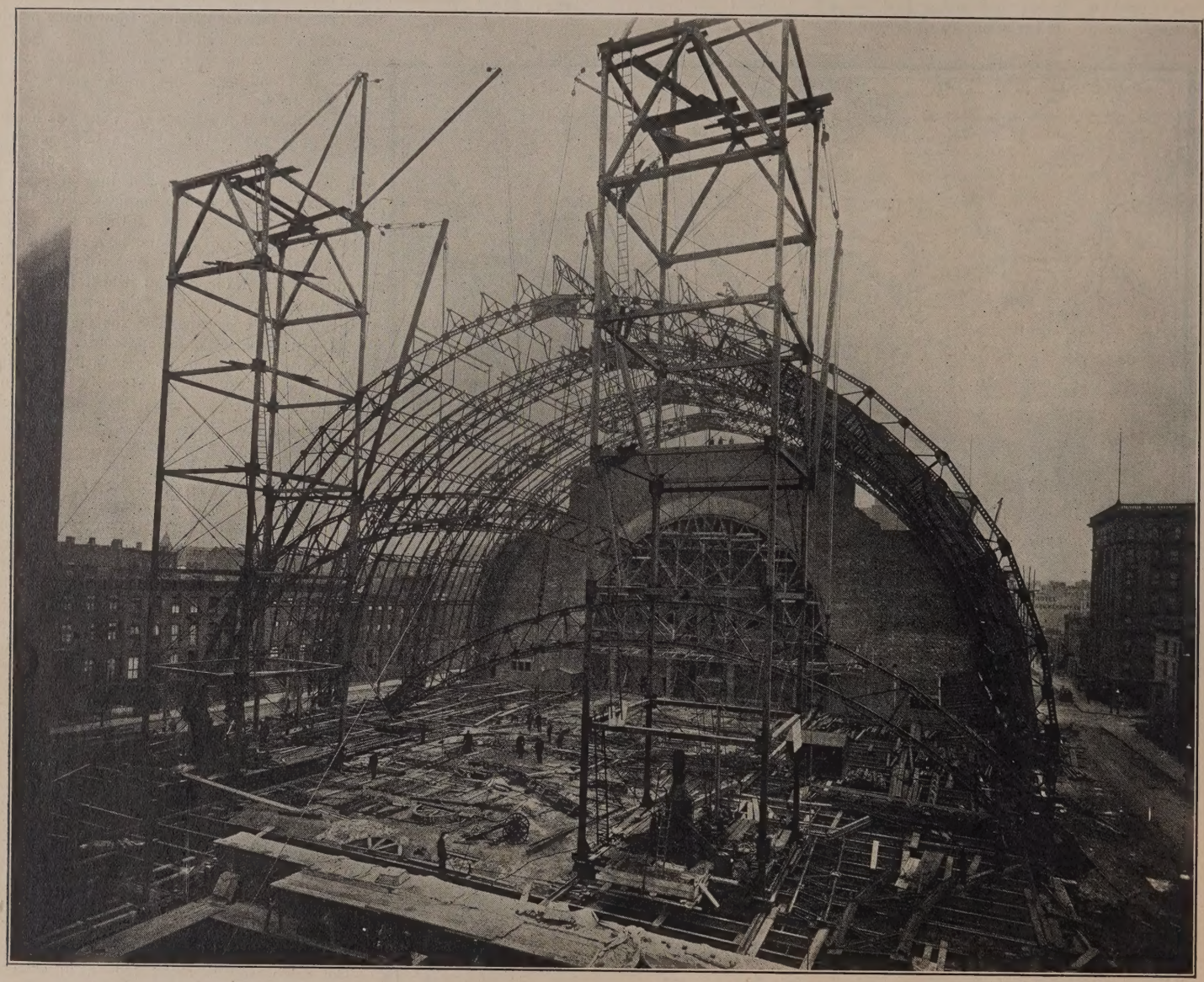
The drill hall is nearly 130 ft. in extreme height above grade and is lighted by a large monitor skylight covering the upper part of the roof. The drill hall has an unobstructed interior with a height of 99 ft. 10 in. from the floor to the lower chords of the roof trusses at the crown. The floor is at the level of the first floor in the front part of the building, and is supported in the center directly from the ground, which is not excavated there. At the sides of the hall a basement story has been excavated, and the floor is supported with ordinary beam and girder construction. Up to the level of the second floor of the front part of the building the side walls are of brick and concrete masonry carried on brick arches below grade, which are sprung between the piers supporting the roof trusses.

The end of the drill hall nearest the four-story part of the building is closed by a brick gable wall about 9 ft. 8 in. in the clear from the adjacent transverse wall of the four-story building. The latter wall is pierced, as shown in the end elevation, by a number of second-story archways communicating with the drill hall balcony and by a central 18-ft. and two 6-ft. side arches at the level of the drill hall floor. The main balcony and the short upper balcony are lighted by windows in the drill hall monitor, and the lower balcony projects continuously from the main building into the interior of the drill hall, where it is supported by cantilever girders fulcrumed on a transverse line of 24-in. 90-lb. I-beams. This balcony is continuous with a somewhat narrower balcony extending around the other three sides of the drill hall and supported entirely by steel cantilever girders. A full-centered arch of 90 ft. 2 in. clear span pierces the gable wall and allows for the construction of the transverse balcony. The arch is built with red brick twenty courses deep at the crown and twenty-eight courses deep at the horizontal skewbacks, which are 24 ft. above the level of the drill hall floor.

The gable wall is about 116 ft. in extreme height above the drill hall floor and is about 36 in. thick at the level of the balcony floor 8 ft. below the arch center. At a distance of 5 in. below the drill hall floor a 24-in. 90-lb. I-beam, made in a number of successive lengths thoroughly web-spliced together, reaches across the building from out to out of the side walls and is built solid into the masonry of the gable wall. Across the arch span these I-beams are supported by two intermediate masonry piers, over the tops of which they are spliced. On each side of the arch the beams are continuously supported by the transverse interior wall and have vertical 6x4-in. angles riveted to both sides of the web 3 ft. apart in order to bond them thoroughly with the masonry and take up any lateral thrust from the arch.

At the opposite end of the drill hall the gable wall, 48 in. thick at the main floor level, is carried throughout nearly all of its length on a con-

tinuous masonry footing. At one end, however, it spans an opening of about 33 ft. over the basement rifle range and is carried there by five lines of 24-in. 90-lb. I-beams in two sections. The outer ends of the beams in both sections are carried by the wall masonry, and the inner ends are web-connected to a deep longitudinal plate-girder in the floor of the building, which in turn rests on the cap of a vertical column made with four 10-in. 15-lb. channels and two 30x⅝-in. cover-plates. It is seated on a grillage 52 in. square, made with three 24-in. I-beams in the upper tier and six 10-in. I-beams in the lower tier. The other floor-beams and girders in the four-story part and in the hospital wing are of ordinary I-beam and plate-girder construction, which are supported everywhere on masonry piers and on interior and exterior walls.



Erection of Semi-Arch Trusses in Drill Hall Roof.

The drill hall roof is carried by six pairs of three-hinge riveted arch trusses, shown in elevation in the general cross-section. Each truss has a span of 189 ft. 8 in. and a rise of 103 ft. 4 9-16 in. center to center of pins. The lower chord is an elaborate curve carefully designed to produce the required architectural effect and composed of arcs drawn from three different centers for each side, and was very carefully bent at the shops to a continuous curve from skewback to skewback. The upper chord corresponds substantially to the lower chord, but is made in straight lines between alternate main panel points where the purlins are connected. The trusses were designed for 50-lb. dead load and 30 lb. live load per sq. ft. of horizontal projection of the roof, and for 20 lb. per sq. ft. dead load of the skylight and 20 lb. per sq. ft. of vertical projection for wind pressure. These values gave a horizontal reaction of 77,300 lb. at the crown hinge, a thrust of 61,800 lb. and a resultant reaction of 179,000 lb. at the skewback. The radial depths of the trusses vary from about 4 ft. at the skewbacks and 5 ft at the crown to a maximum of about 9¼ ft. over all at the haunches. Each chord has an I-shape cross-section, made with two pairs of angles back to back connected by double lattice bars and web connection plates at panel points in the vertical plane. The flange angles are all 4x3½-in. for the top chord and 5x3½-in. for the bottom chord, except in the crown sections of the trusses, where they are reduced to 4x3 and 3x3 in. angles in both chords.

The ends of the trusses are nearly vertical, and the lower panel is made with a solid web-plate stiffened by pairs of diagonal angles convergent to the 4½-in. skewback pin. The pin bearing is reinforced to a total thickness of 3 in. by side-plates and cover-plates. The bearing is semi-circular except that the cover-plates project beyond the center line of the pin so as to form jaws engaging the web of the shoe. The construction at the crown is substantially the same, except that the pin is only 3 in. in diameter and its bearing is 1½ in. wide. The webs in the adjacent sections are cut with a clearance from the vertical center line of the pin, which varies from ½ in. at the center of each chord to ⅛ in. at the center of the pin, thus allowing play for the temperature movements of the semi-trusses. The outside pin reinforcement plates form jaws, shop-riveted to one semi-truss and engaging the web of the adjacent truss without rivets or bolts. The truss is divided into panels from about 4½ ft. long at the crown and skewbacks to about 9 ft. long at the haunches, and each panel is X-braced by pairs of angles engaging the web connection plates projecting beyond the inner flanges of the chords. In most of these panels the angles in one diagonal are made continuous and in the other are cut to clear, all of them being riveted to connection web-plates at the intersections. At alternate panel points the chords are connected by radial members formed of pairs or double pairs of angles receiving the purlins.

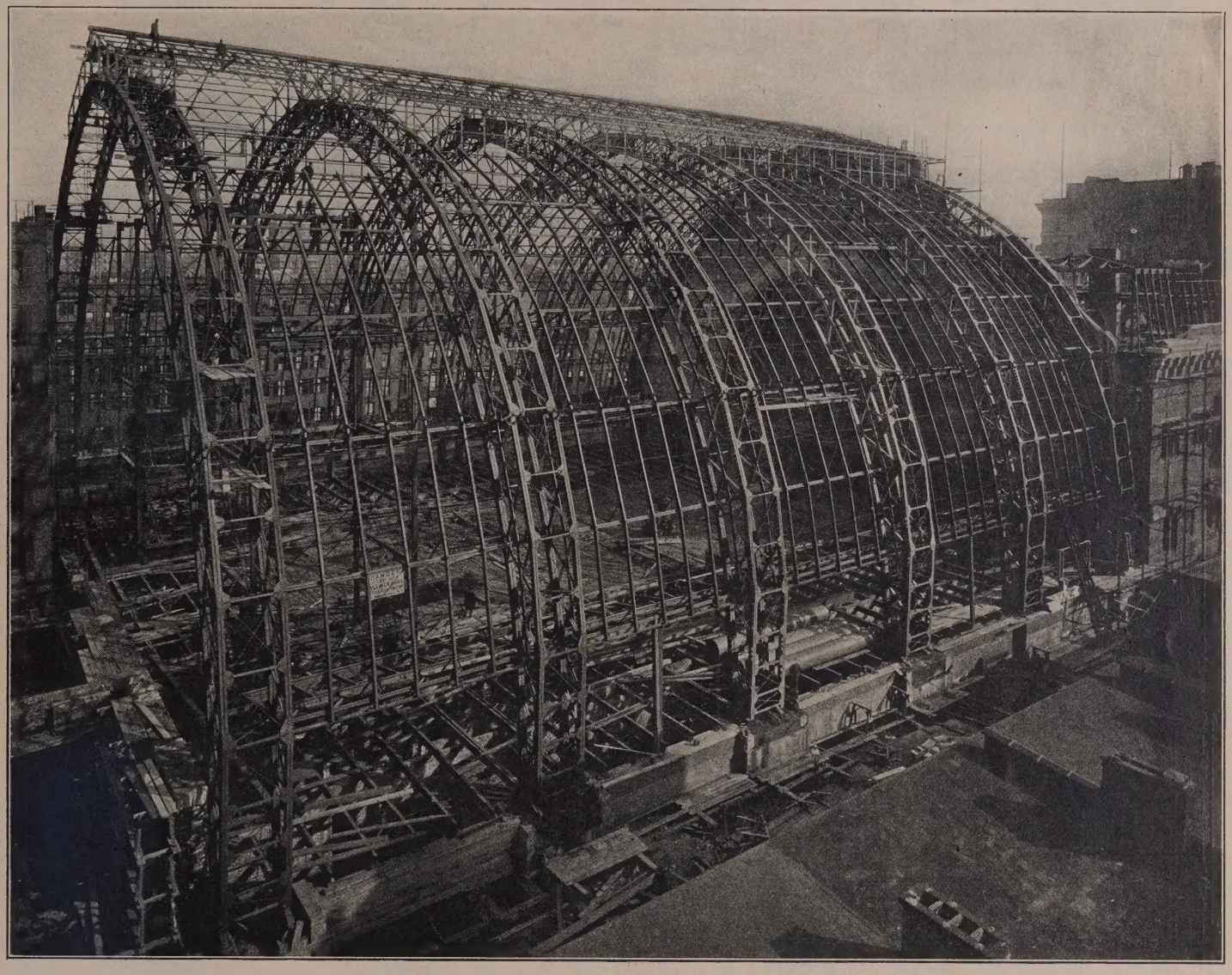
Each semi-truss was shop-riveted in four sections. In each section the bottom chord flange angles are continuous from end to end, but the top chord flange angles have milled butt joints at every alternate panel point where their direction changes, and they are spliced by the web-plate and by top and bottom flange cover-plates. The field splices for both top and bottom chords are made like the

shop splices for the top chords, the cover-plate for the outside flange being the full width of both angles and the cover-plates for the inside flanges being made with separate strips for each flange angle on opposite sides of the web plate. All field splice-plates are shop-riveted to one section of the truss and field-riveted to the adjacent section.

About 20 ft. above the skewback pins the lower-chord splice-plate is made extra large and projects beyond the outside flange angles to afford connection for the cantilever beams of the gallery floor, which is stiffened by a knee-brace to the next lower panel point of the arch truss. One complete truss weighs about 60,000 lb. and requires about 600 field-driven rivets besides those in the connections for longitudinal and transverse braces.

The arch thrust is provided for by a horizontal tension member connecting the skewback pins. The ends of this member are made with pairs of 15-in. I-beams, web-spliced together so that they will serve not only for ties but act as floorbeams in the basement ceiling. Each tie has three pairs of I-beams at each end, and between them there are two 1¾-in. bars with loop eyes connected to the I-beams and turn-buckle adjustments in the center. These struts are supported on interior walls at each I-beam splice, and the round rods are carried in shallow trenches under the drill hall floor.

The skewback pin is seated in a half hole in the single web of the riveted shoe, which is stiffened by six pairs of transverse gusset plates and flange angles riveted to the upper edge. There is a truss at each end of the drill hall which is anchored to the brick gable wall by horizontal bolts through the center lines of the top and bottom chords at alternate panel points. These bolts have at one end double nuts engaging the chord web and at the other end forged heads engaging washers which bear on two vertical side strips filered out from the brick-work, and are free to move up and down between them in accordance with the temperature variations, the heads of the bolts being provided for by a shallow chase in the brick-work.

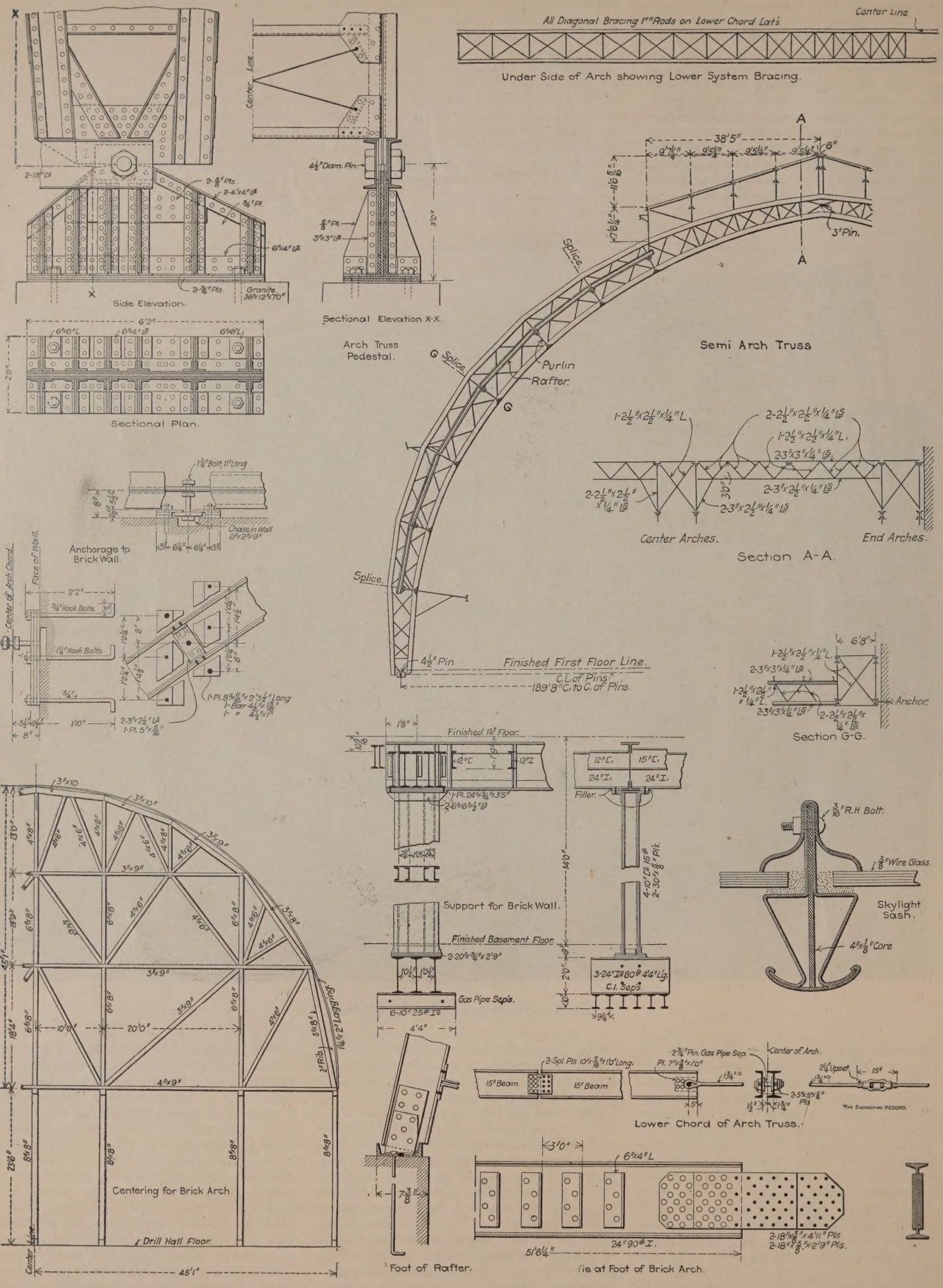


Completed Steel Framework of Drill Hall Roof.

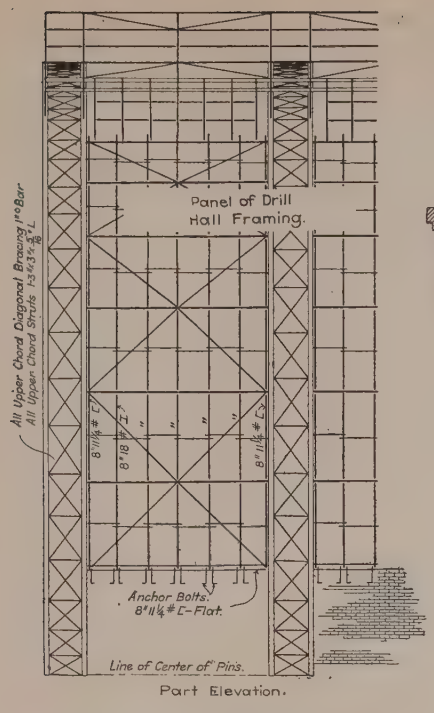
At the hips of the arch trusses the brackets are riveted to the top chords to sustain the main gutters, which are moulded from solid concrete, as indicated in the detail sketch.

The trusses are braced together in pairs 6 ft. 8 in. apart on centers by means of radial longitudinal horizontal struts and X-braces, each made with a single 3x3-in. angle at every panel point, twenty-four in each semi-truss, besides which there is 1-in. round X-bracing in the planes of the top and bottom chords in each alternate panel formed by these cross frames. The pairs of trusses are 38 ft. 9½ in. apart on centers and are connected by fourteen longitudinal purlins, exclusive of the skylight framing. The purlins are connected to the truss at alternate panel points and are lattice girders of varying depths, with their bottom flanges flush with those of the lower chords. They have T-shape flanges made with pairs of 3x3-in. angles, and the depth is uniformly half of the varying depth of the arch trusses at the respective points of connection. The end and center main panels of the roof are X-braced below the lantern by lateral rods 1 in. in diameter, which cross two panels of the purlins.

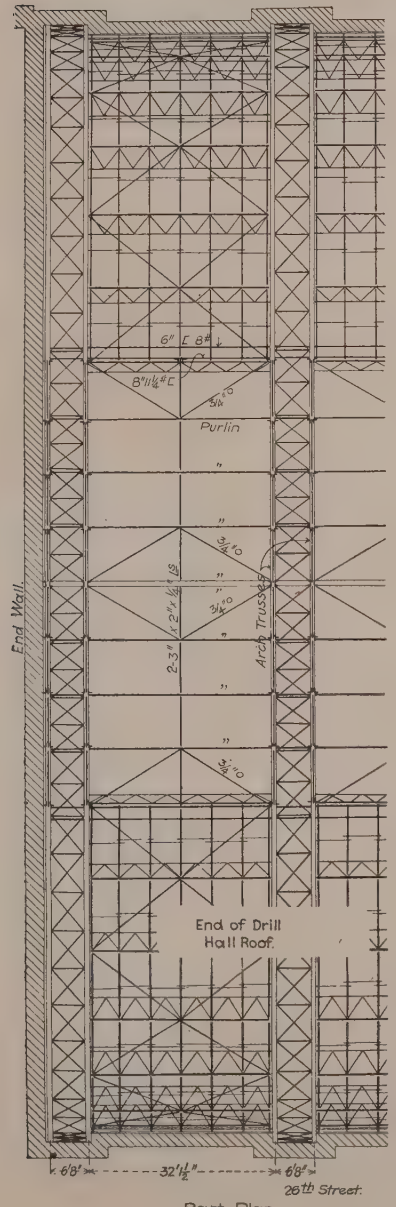
The purlins carry on their top flanges five intermediate lines of 8-in. I-beam rafters, besides a line of 8-in. rafter channels adjacent to each arch truss. These members support the concrete roof slabs. The skylight extends the full length of the drill hall and has a width of about 40 ft. each side of the center line, giving it total dimensions of about 80x202 ft. It is made with a double line of longitudinal purlins in the center and three lines of single longitudinal purlins on each side, making eight lines in all. The purlin at the monitor eaves is an 8-in. channel with a center support. The other purlins are lattice-girders with a uniform depth of 3 ft., and they have their top flanges flush with the skylight line. Both flanges have T-shape cross-sections made with 3x3x¼-in. angles connected by pairs of zigzag 2¼x2¼-in. web members. The end lower flange panel points are knee-braced to the upper flanges of the arch trusses. These purlins are connected by intermediate transverse angle-ties in the center of each panel and



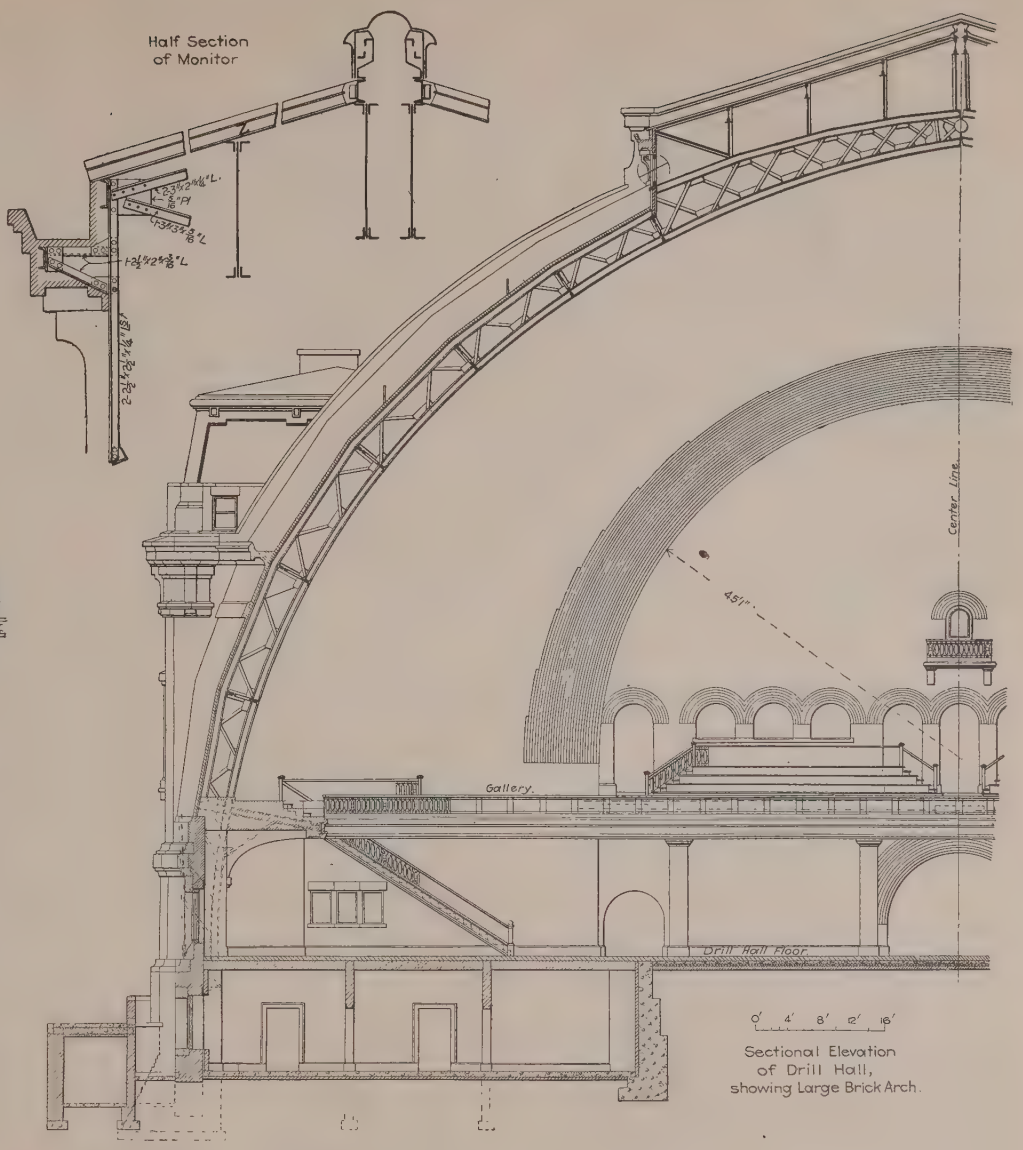
SKEWBACK PEDESTAL, ARCH DIAGRAMS, MISCELLANEOUS STEEL DETAILS AND CENTERING FOR BRICK ARCH.


All Upper Chord Diagonal Bracing 1"ø Bar
All Upper Chord Struts 13"x3½"x5/16" L
Panel of Drill Hall Framing.
8"11¼# C
8"18# I
8"11¼# C
Anchor Bolts. 8"11¼# C-Flat.
Line of Center of Pins.

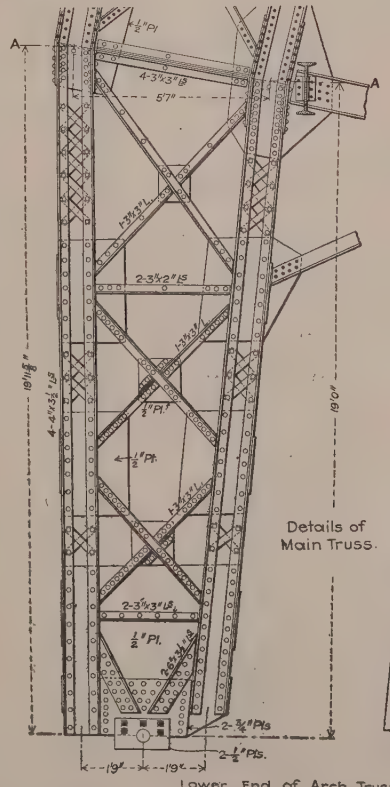
Part Elevation.



Part Plan.

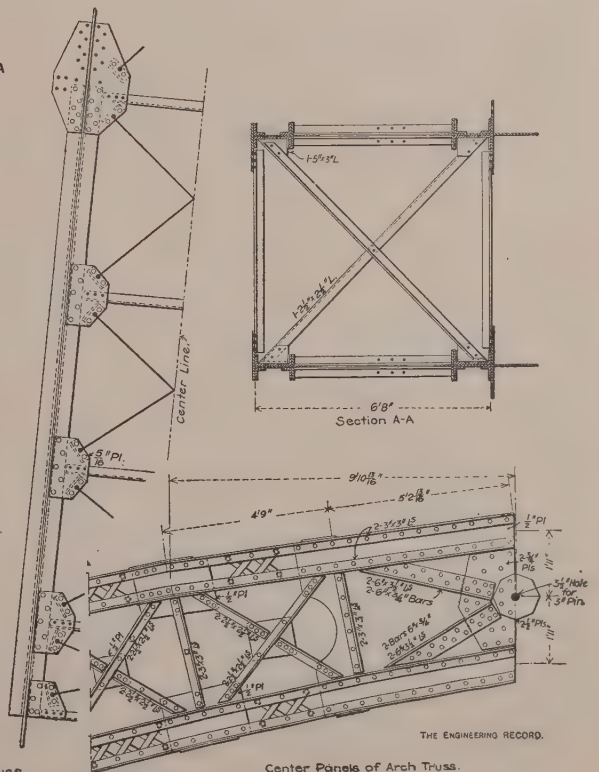


Sectional Elevation of Drill Hall, showing Large Brick Arch.



Details of Main Truss.

Lower End of Arch Truss.



Center Panels of Arch Truss.

TYPICAL PANEL OF STEEL CONSTRUCTION, ARCH DETAILS AND 190-FT. BRICK ARCH.

support on their top flanges sheets of 3⅜-in. wire glass about 20 in. wide. The glass is secured to special transverse sash bars made as shown in the enlarged cross-section.

At the eaves of the lantern the purlins carry riveted brackets with a light metal furring, on which is formed a gutter of solid concrete. At the ridge of the lantern the parallel purlins, about 12 in. apart on centers, are connected by a cap built of galvanized iron stiffened by longitudinal angles which has sufficient flexibility to allow for all temperature movements. The panels between the purlins at the ridge and those at the eaves are all braced with single ¾-in. screw-ended zigzag rods in the planes of the top flanges.

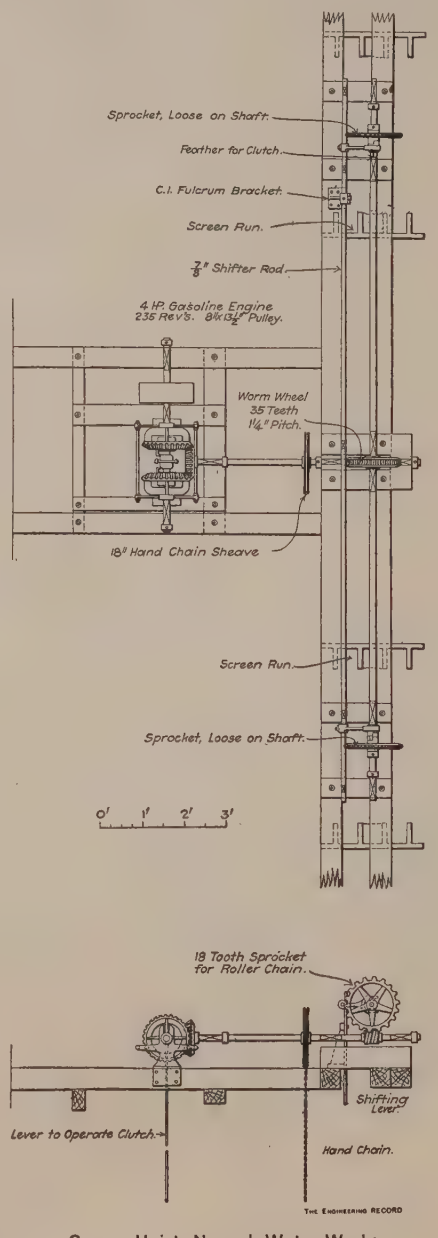
The trusses were assembled completely on the main floor of the drill hall and were lifted into position by four 60-ft. booms mounted on the corner posts of two traveling towers 25 ft. square and 116½ ft. high. Each tower had four 10x10-in. vertical posts, made in several sections and spliced with butt joints and steel connection plates, which also received the horizontal wooden struts and the pin-connected diagonal rods in the panels, which were 19 ft. high.

The tower sills were made with pairs of channels, between which were four double-flanged wheels on each of two rails 25 ft. apart. The sills supported transverse steel beams carrying the platform for hoisting engines, fuel, etc. Vertical wooden bearing timbers about 18 ft. long were clamped to the posts in the third panels, and their upper ends formed seats for horizontal steel beams across the longitudinal sides of the towers on which were seated the derrick booms. A stiff-leg derrick was seated on the top of the tower, with its foot supported by a pair of horizontal diagonal beams in the corner of the tower. The tower was braced by horizontal diagonal rods in the plane of the upper and lower transverse struts. Each traveler was equipped with two Lidgerwood double-drum hoisting engines, and as the work progressed receded from it on longitudinal tracks. The erecting gang was followed by several gangs of hand riveters and pneumatic-hammer riveters.

The total amount of excavation for the armory and drill hall basement and foundations amounted to about 17,000 yd. and was made by hand, and the spoil was removed in wagons drawn up an inclined causeway to the street, except some from under both sides of the drill hall, which was used for a 10-ft. fill under the drill hall floor. The excavation was carried down below ground water level, which was at about 11 ft. below the curb, so that the finished floor was just above water line. The footings and foundations were in most places carried down about 8 ft. below water level in sheeted pits, kept dry by hand pumps. After the completion of the exterior wall footings most of the sheet piling was pulled.

At the west end of the building considerable trouble and extra expense was occasioned by unexpectedly encountering an underground stream flowing from north to south. Its bed was 20 ft. or more below the curb and was filled to a depth of about 8 ft. with boulders and soft mud, through which it was very difficult to drive the sheet piles. The stones were removed from under them as the excavation progressed, and they were finally driven below the river bed and the pit was kept dry by draining the adjacent area through two 4x4-ft. sumps about 25 ft. deep, sunk in advance and emptied by two men working continually on a 4-in. pump. The first sump was located at the up-stream end of the excavation, and a pit about 50 ft. long was dug and the continuous concrete footing quickly placed in it, and then another sump was dug at the up-stream end of the other half of the excavation and the remainder of the footing was completed.

At the north end of this footing, west of the drill hall, there was a seven-story apartment house with poor brick walls and footings above the bed of the subterranean stream. The side wall parallel to the end of the drill hall was underpinned by the usual needlebeam method, but, as the end wall was near the parallel end wall of the hospital wing with much deeper footing, it was considered very dangerous to excavate for the latter without underpinning and involving costly work. What amounted to a permanent retaining wall was therefore put in between the two buildings to prevent any disturbance of the natural soil beneath the footings of the apartment house walls, which were left undisturbed. The area between the two buildings was carefully sheeted and braced and a pit dug in it to the level of the new footings and the



Screen Hoist, Newark Water Works.

bottom covered by a 16x30-ft. mass of concrete 5 ft. thick, which served to hold firmly the feet of the sheet piles, which were braced against the retaining wall and cut off at water level and the lower parts left permanently in the ground.

As there are no columns in the building, the floors are carried by the walls, and they are unusually thick. Up to the water table, a height of about 12 ft., they are built of concrete, faced where exposed with 4 in. of red brick. On the outside the bricks are laid in contact with the face of the concrete. Inside there is a 2-in. air space intervening; at window openings the brick returns are 12 in. thick. The walls are about 40 in. thick at the base and have footings offset to about 10 ft. in width in most places, but vary somewhat. On the sides of the drill hall they are carried on heavy brick arches sprung between the roof truss piers. The concrete was laid in ordinary moulds made with horizontal boards 9 in. wide. Morse steel wire anchors 16 in. apart were set horizontally in every crack between the boards of the moulds, projecting half way into the concrete, and were built into the brickwork as the latter was laid up after the removal of the moulds. On the inside of the wall these anchors project across the air space to engage the brickwork.

About 4,000 cu. yd. of 1:2:5 concrete was used and was made with Portland cement of both Lehigh and Atlas brands. The concrete tower near the center of the lot had sand and stone bins on top, which were filled by a Jeffery Manufacturing Company's bucket elevator, operated by the Orr & Sembower engine which drove the Ransome drum mixer. They delivered directly to the charging hopper, and the mixer discharged into wheelbarrows, by which the concrete was distributed to the different parts of the building. The concrete for the roof and floor slabs was mixed by a Foote machine and was hoisted by a Pelham hod hoist. Bricks and mortar were hoisted by two Buckley's hod hoists; large stones were hoisted by two guyed boom derricks on the Lexington Ave. side, and several ordinary breast derricks were used on the wall masonry. Floorbeams and girders were hoisted from trucks in the street by a large boom derrick on the 25th St. side and were distributed at the different levels and erected by breast derricks moved around on the different tiers of beams. There were in all seven separate boilers serving the different engines for the concrete mixer, hod hoists and derricks, the latter being operated by Lidgerwood double drum engines.

All floor and roof slabs are of the Roebling standard reinforced concrete fireproof construction. In the drill hall and gymnasium the floors are of segmental arches; elsewhere they are flat slabs supported on the tops of the floorbeams. The roof slabs are the same and are covered with a special waterproofing compound made by the Star Composition Roofing Company, New York, which has the property of remaining soft in cold weather and hard in hot weather. All of the floor slabs have suspended concrete ceilings below them and aggregate about 70,000 sq. ft. There is about 55,000 sq. ft. of concrete roofing, which, with the flooring and ceilings, is made 1:2½:6 with Vulcanite brand of Portland cement.

The 90-ft. arch in the east gable wall of the drill hall is among the largest of brick arches in the United States and is perhaps the largest of them in a building. It is 10 ft. deep at the skewbacks and 8 ft. deep at the crown and is 3 ft. thick. These dimensions correspond to a very heavy weight, and special care was exercised in building it in order to avoid settlement and overstraining the centering. It was supported during construction on 2 in. lagging on four lines of scarf boards, each made of three 2x12-in. planks, breaking joints in the usual way, and supported by vertical and inclined posts from a simple falsework of vertical posts and X-bracing seated on the drill hall floor girders, with pairs of folding adjustment wedges under each vertical post. The arch was built in six sections, arranged so that at the crown and haunches the intrados was first completed and carried the weight of the extrados without imposing the full dead load of the arch on the centering.

Six masons at each end of the arch first built up the full depth of the arch ring, 28 courses, to a height of about 20 ft. and racked it off in a nearly horizontal line at the top. This brickwork was so nearly vertical that it imposed only a slight thrust and very little vertical load on the falsework and was built in three days and allowed to set for a week. A force of ten bricklayers on each side of

the arch then built two more sections of the arch ring of about half the required thickness, or 4 ft., reaching to about 15 ft. from the center line. These sections were also allowed to set for a week, and then as many men as could work to advantage were put on and completed the half thickness arch ring to the crown and keyed it in one day. Without further delay the arch ring was completed to its full depth and the wall built up about 8 ft. above it. The wedges were then slacked to swing the arch, but the falsework was not then removed because it happened to support some other scaffolds. All bricks in the arch were laid in 1:3 Atlas cement mortar, and no settlement was noticed after the arch was swung. Work was commenced Feb. 15 tearing down the 32 old houses that previously occupied the armory site, and on Jan. 1, 1905, about 150 of the working days allowed in the contract for the completion of the building were still left. An average force of about 75 masons was employed, and the general construction was supervised by Mr. J. R. French, superintendent.

Hunt & Hunt are the architects of the building, Mr. M. Lewinson consulting engineer, and James D. Murphy Co. are the general contractors. The steel-work was built and erected by Milliken Bros., New York.

LOCAL ASSESSMENTS FOR PAVING have recently been before the Colorado Supreme Court in Denver v. Londoner, 80 Pac. Rep. 117. The court upheld the assessment of the expense for paving on all abutting property in proportion to the frontage of each lot, provided that where the lots are not of the same depth they "may be assessed to a substantially equal depth, not less than 20 nor more than 150 ft. from the street improved." Strips less than 20 ft. deep are not exempt from assessment, but the amount must be "just and equitable"; the method of determining the amount is not stated in the opinion of the court.

Mechanically Operated Screens, Newark Water-Works.

The Cedar Grove reservoir of the Newark, N. J., water-works was described in The Engineering Record of Dec. 5 and 12, 1904. It is a service reservoir of 700,000,000 gal. capacity, built to hold about a month's supply at a point considerably nearer the city than the impounding reservoirs on the Pequannock River, which are 21 miles from the city. The reservoir is a mile long and an eighth of a mile wide, and will cost when completed about $2,000,000, including a 3,000-ft. tunnel, an 8-mile pipe line and connections with the city mains, and with two small distribution reservoirs in the city.

The outlet gate chamber controlling the flow of water to the city is located in the basin about 65 ft. from the flow line, where the water is 50 ft. deep. In this chamber are four 8x6-ft. wells, through which the water passes before entering the distribution system. In the two front wells are cast-iron grooves, in which the screens slide. The problem of handling these screens has been solved in a novel manner, and at the recent convention of the American Water Works Association Mr. J. Ralph Van Duyne, resident engineer at the reservoir, described it as follows:

The frames for the screens, instead of being made of wood, as is customary, are 2½x2½x⅜-in. steel Tees bent to form a 4-ft. 7-in. square. On to this frame is riveted a sheet of No. 18 hard copper punched with 5-16-in. holes 7-16-in. on centers.

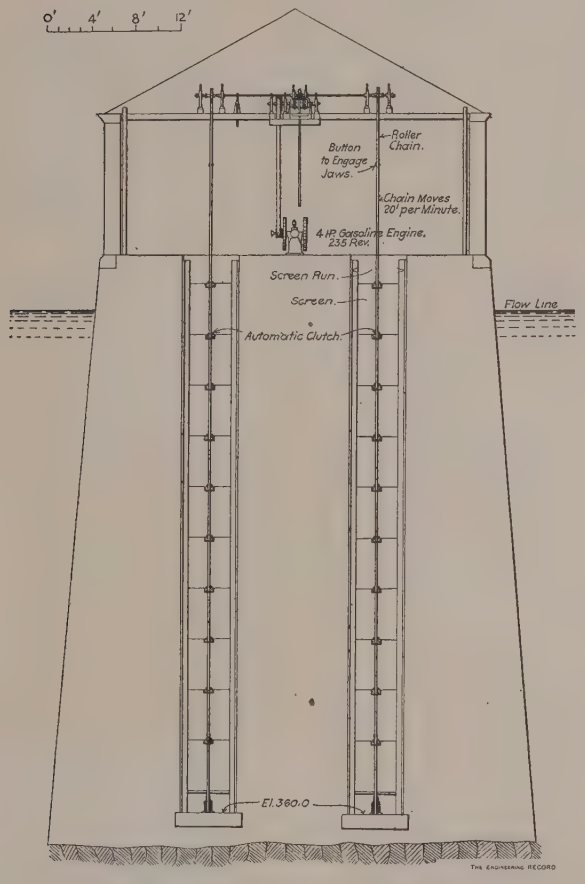
At the center top edge of each screen is attached a pair of sliding jaws, which are forced upwards by a stiff spiral spring converging as they rise. As the screens are placed one on top of the other, the jaws of each underscreen are forced down and open by the weight of the screen above, so that when the screens are all in place all of the jaws are down except those of the top screen.

The power transmission to raise and lower these screens is very simple. On a shaft 12 ft. above the floor of the gate chamber are placed two sprocket wheels, one over each well in which the screens are located. Engaging these wheels is an endless sprocket chain extending 60 ft. down to idlers at the bottom of each well. Two special links or buttons one inch greater in width than the remaining links are inserted diametrically opposite each other in each chain. These chains pass through the jaws attached to each screen, and the jaws are so spaced that when pressed down both chain and button will pass through; when the jaws are released, however, only the chain can pass through them, and hence, as the button comes up it engages in the jaws of the top screen and raises this screen out of the well.

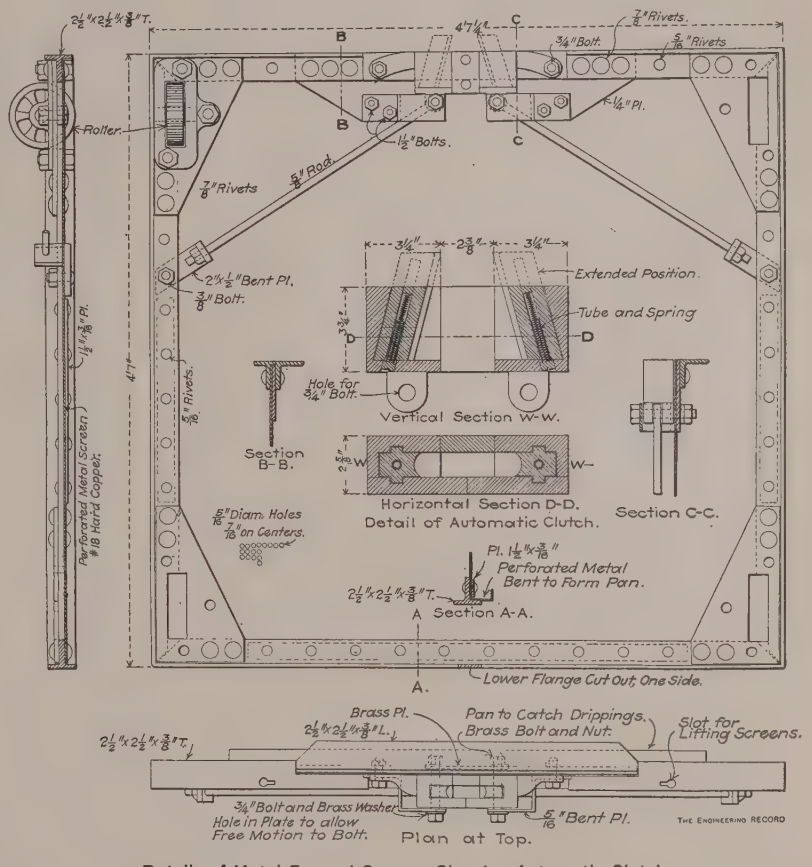
Cams which hold the jaws together are then swung back, the jaws are opened and the screen is released from the chain. It is then picked up by a differential chain block and carried on an overhead track to the center of the chamber, where it is washed and then either returned to the well or stored in another part of the gate-house.

A 4-h.-p. gasoline engine, with a friction clutch attached to the pulley, furnishes the power, and a worm wheel drive is used to transmit the power to the main shaft on which the sprocket wheels are placed. A shifting lever is used to throw the sprocket wheels into clutch with the main shaft, and a double beveled gearing is used to reverse the direction of the shaft. The screens are raised out of the wells at a rate of 20 ft. per minute.

While the apparatus has not as yet been in actual operation under all conditions of service for which it is designed, the tests made up to the present time have been satisfactory. The original design was worked out by Mr. Carleton E. Davis, and the apparatus has been installed by Mr. Van Duyne, under the direction of Mr. M. R. Sherrerd, chief engineer.



Arrangement of Screens and Hoists.



Details of Metal Framed Screens Showing Automatic Clutch.

High Pressure Systems for Fire Service.

Report of Committee of National Fire Protection Association.

The subject given us under the above title first came up for our consideration due to the investigation by a committee of this association of a system of street fire mains established in Philadelphia, Pa., and fed from a high pressure gas engine driven pumping station. Furthermore, our attention was called to a proposed system of fire mains in Chicago, Ill., fed by high pressure pumps. As a result, it has been suggested that such systems might become more generally used due to the fact that in a great many places throughout our country the domestic water supply has been found inadequate for fire service, and in other places is under suspicion.

Again, the inefficiency of existing portable steam fire engine service is becoming more and more apparent.

The following is a summary of recent tests of steam fire engines picked at random from service equipment of many of the best city departments in the country: Number of engines tested, 102; nominal capacity, 69,800 gal.; actual capacity, 55,900 gal.; percentage of efficiency, 80 per cent. In many cases the efficiency of individual "steamers" is less than 50 per cent.

These tests were made under conditions favorable to the engines; time, location and conditions were selected by the departments and every endeavor made to secure best results at tests. The duration of the tests was very limited, but even under these conditions the percentage of efficiency is low, and it is evident that under stress of conditions obtaining during serious and prolonged fires or conflagrations, with frequent changes of location, less careful handling and continued stress of work, the efficiency would be much less than in the tests. The low efficiency of fire engine pumping may be due to mechanical defects, fouling, improper handling, poor stoking, unsatisfactory fuel, or other causes. To obtain best results for these apparatus a combination of favorable conditions seldom or never met with in practice is necessary. Stationary pumping plants in large units, under ample power and with well trained operating force, are not subject to the many adverse influences that affect the individual fire engine and can deliver supply both in quantity and force unattainable by any other practicable means.

Quantity and force of delivery are essential to cope with extreme conditions. Whether the numerous powerful streams that can be derived from high pressure systems such as have been recently designed will be sufficient to check a conflagration when once well under way is not claimed, but it is indisputable that the force at the disposal of a fire department will be largely augmented and may be concentrated to better purposes.

All this has prompted a desire for a review of our subject, that the functions of a high pressure service may be outlined and understood, and the most feasible methods pointed out for attaining the desired results.

The term "high pressure" here applied is in contradistinction to a low pressure service such as is adequate for efficient hose stream purposes. This "high pressure" might be spoken of as "adequate pressure," or, "adequate direct pressure," meaning a sufficient pressure for fire streams when directly connected to hydrants without the intervention of steam fire engines.

A high pressure fire system must at all times be capable of furnishing a supply of water adequate, both in volume and pressure, for the local needs and uses.

Where such a system is to be specified, its proper uses (outlets) will be found to be much the same for all cities, and the pressure necessary will not vary greatly, but the quantity of water advisable and the water supplies available will be found to differ materially.

Water Outlets and Pressures.—In the consideration of this subject, we will start in at the point where the water is discharged, in order that we may determine the pressure and volume required and thereby suggest the hydrants, piping and water supplies necessary.

A water system for fire extinguishment to be comprehensive should be capable of feeding all of the following services:

(1) Inside Hose Streams, as connected with standpipes or brought into building by a fire department, for which 25 lbs. minimum nozzle pressure is desired. It is to be noted these streams are subject to intermittent use, as by the operation of a shut-off nozzle.

If it is desirable, as hereafter pointed out, to maintain a high pressure system in constant automatic service at a minimum pressure of 100 lbs. in the pipe line, and to take the "first stream" brought into a building by the department from a high pressure hydrant, such a stream can be easily handled under a pressure of 100 lbs. at the hydrant, and, if desired, could be used at reduced nozzle pressure by throttling at the hydrant valve.

The inside metal standpipes when used for a fire inside the building in which they are located, could be put in service by opening a gate valve in a metal pipe connection from the high pressure street main to the standpipe, said gate valves being normally closed and under sole control of the Fire Department or by connecting flexible hose from the nearest high pressure hydrant to the siamese inlet of the standpipe.

For this and similar purposes, hose of diameter not less than 3 inches should be employed.

For the 25-lb. minimum nozzle pressure inside standpipe stream, 100 lbs. at the high pressure street main would provide for the stories of buildings up to 100 ft. in height. An ability to increase this street pressure to 200 lbs. would take care of the interior standpipe service for a fire in the building in which the standpipe was located in all structures likely to be erected.

For use by the occupants of the building before the arrival of the Public Department, domestic city water supply, gravity or pressure tanks can be kept connected with the standpipes.

(2) Automatic Sprinkler Systems, as used in the interior of numerous buildings, and destined to be much more generally employed in the future, are the most efficient known means of fire extinguishment. These systems require for fully satisfactory service not less than 25 lbs. pressure at highest sprinkler level, and the approved makes, together with the piping and valves of the system, are safe under 300 lbs. pressure. It will, therefore, be seen that pressures which properly serve the above noted inside hose stream service will be adequate for automatic sprinkler systems. These systems require an automatic supply of good pressure at all times, which is now and can continue to be provided by pressure of gravity tanks, or domestic water supplies where the latter are of value for this purpose.

We recognize as debatable the practice of connecting the high pressure system to the automatic sprinkler system through metal piping and keeping this supply in automatic service at all times. Against this procedure it is stated that, should a fire get beyond control in such a sprinklered risk and break the large piping, the high pressure service would thereby be bled through a large vent, either 4 or 6-inch size, the latter under considerable pressure readily discharging as much as 7,500 gallons per minute. The breaking of one such connection might perceptibly affect the pressure in the high pressure mains, and the breaking and discharge through two or more might seriously impair or destroy the efficiency of a high pressure service.

Ordinarily, a fire would not get beyond control in a sprinklered risk because the sprinklers would prevent, but there are a few conditions which might bring to pass, such as a sprinklered risk burning due to a portion or all of the sprinkler equipment being out of service due to oversight or repairs, or to the system being overcome by unusual internal conditions, such as an explosion. Should such a disaster occur, recourse would next be had to the gate valve in the connection from the high pressure main to the sprinkler system, which would be located outside the building. Importance attaches to its precise location, as it should be well away from the wall and not directly in front of the building being supplied, but say 20 ft. to one side, so that access to it would be less likely to be prevented by heat, smoke or falling walls. Such gate valves would be located in pits near center of street accessible by manholes, or of gate posts type, located at sidewalk margins.

Finally, in event of a sprinklered building burning due to one of the causes above cited, and the outside control gate valve being inaccessible due to adverse circumstances, the waste of water through the connection could be stopped by closing the gate valves in the high pressure main next nearest in both directions. This, however, might involve the shutting of other connections to other sprinkler systems, to standpipes, and to street hydrants located on both sides of the street in the same block. It is, of course, true that siamese hose inlets could be provided for sprinkler systems to which connection could be safely made from the high pressure hydrant upon arrival of the Department. This would mean a delay of several minutes, fatal to automatic sprinkler protection. Hence, it is necessary to have the sprinkler systems fed at all times by a high pressure connection, or by independent satisfactory water supplies at each building.

It is therefore seen that an important usefulness of high pressure connections to sprinkler systems would be in rendering unnecessary a great deal of expenditure now necessitated in furnishing private water supplies. While but few property owners take advantage of the benefits of sprinkler protection, such a course might be considered unnecessary, but with the general introduction of sprinklers into city properties which is bound to come about and which will be stimulated by the use of a high pressure service connection for water supply, the community will doubtless be benefited by the making of such connections, which should, however, be most carefully safeguarded.

We, therefore, have to recommend that automatic sprinkler systems be regarded as among the proper outlets for a high pressure fire system; that a permanent metal pipe connection for automatic constant service should be allowed from the street main to well installed and maintained sprinkler equipments; that pipe 4-inch size is adequate for giving the initial pressure and service, pending the arrival of the Fire Department; and that siamesed hose inlets to sprinkler systems be provided in addition for the connection of high pressure hose lines to give increased volume should it be desired after the arrival of the Department; that care should be exercised in the location of the central gate valve in the 4-inch pipe connection, and that laws or ordinances prescribe a penalty for the use of water from the high pressure main through the sprinkler connection for any purpose whatsoever other than fire extinguishment.

(3) Outside Hose Streams, namely, those directed on a fire from without the building in which it is burning.

The loss of pressure due to friction in fire hose is, as a rule, not properly appreciated, and frequently the complaints as to lack of water supply should be more properly lodged against the neces-

sity of using long hose lines. For all such high pressure services, effort should be made to diminish this trouble by very frequently located hydrants and by hose of larger diameter than the 2½-inch now most commonly used for fire streams. Three-inch diameter hose should be the minimum and may be regarded as reasonably satisfactory for this service. It is now used in a number of our large cities and proves satisfactory under heavy pressure, rough usage and long periods of service. Even larger diameter hose, namely, 3½-inch, is in use on the high pressure service system in Philadelphia.

We find no objection raised to 1¼-inch diameter, smooth-bore nozzles as especially well adapted for ordinary inside and outside department streams, but it is generally admitted that, with fires of any consequence, a considerable number of larger diameter streams should be promptly employed, for which purpose 2-inch diameter nozzles are here recommended. The latter, under 75 lbs. nozzle pressure, will discharge approximately 1,000 gallons per minute.

The following table gives the pressure required at hydrant to overcome friction loss in hose streams of various lengths and maintain 75 lbs. nozzle pressure, the nozzle being located at the same level. For the 2-inch nozzle it is assumed that two hose lines, each of the length stated, will be siamesed together.

TABLE OF REQUIRED HYDRANT PRESSURES (LBS.).

Hose diameter	2½-in		3-in.		3½-in.	
Hose lines	Single.	Siamesed	Single	Siamesed	Single	Siamesed
Smooth bore nozzle	1¼-in.	2-in.	1¼-in.	2-in.	1¼-in.	2-in.
Length of hose line, 100 ft.	121	139	92	101	84.5	88
Length of hose line, 150 ft.	139	170	99.5	113	87.5	93.5
Length of hose line, 200 ft.	158	201	107	125	91	99
Length of hose line, 250 ft,	176.5	232	114.5	137	94.5	104.5
Length of hose line, 300 ft.	195	263	122	149	98	110
Length of hose line, 400 ft.	232	325	137	173	105	121

Note.—From data derived from experiments by John R. Freeman (Transactions American Society of Civil Engineers, November, 1899). The loss of pressure in the 3-in. and 3½-in. hose probably represents unusually good conditions, and in practice may somewhat exceed the above figures. Not included in the above are losses not exceeding 5 lbs. incurred in a siamese connection.

In actual practice, an average of about one-third more hose is laid out in a stream than required to reach from the hydrant to the nozzle location if measured in a direct line. With hydrants located with reasonable proximity, this will mean that hose lines varying in length from 100 to 400 ft. will need to be employed, and we must provide pressures sufficient to overcome the friction loss under the most severe conditions, namely, in 400 ft. hose.

Outside hose stream service is divided into the following four classes:

(a) Hand-held Portable Streams Operated from the Ground.—Seventy-five lbs. pressure at the nozzle is about as high as is feasible and allow the control, direction and moving about of such streams while in service, even if in the hands of a well-trained squad of firemen.

It is seen from the foregoing table that 173 lbs. hydrant pressure is required to feed a 2-inch smooth bore nozzle, discharging, approximately, 1,000 gallons of water per minute, viz., at 75 lbs. nozzle pressure if two lines of 3-inch good quality hose, each 400 ft. long, are used. Therefore, to provide for this class we must be able to maintain pressures at the hydrants varying, let us say, from 100 to 175 lbs.

(b) Machine-held Semi-portable Streams Discharged from the Ground.—There are now various devices for relieving the recoil at the free end of the hose stream and making it easy and comparatively safe for one or more men to care for the nozzle. Small platforms with metal universal joint play pipes and connections attached are used for this purpose, similar fittings mounted on apparatus wagons, and also legs which rest upon the ground and are at the other end strapped or attached to the play pipe.

Such devices are of material importance in facilitating the use of high pressure streams, and the better types should be ascertained and recommended. With some of them, a moderate increase of service pressure over that obtained with ordinary hand-held stream is feasible, and with others, there is no practical limit to the increased pressure which can be safely handled.

We believe, however, that a 2-inch nozzle discharge under 75 lbs. nozzle pressure possesses the qualities necessary for effective service from the ground, and that no higher pressures are advisable for this type of service, even if buildings are unusually high, as increased pressure would not materially better the penetration of such a stream within stories at a high level. The angle of discharge from ground streams renders them of comparatively little service above the fourth or fifth stories of average buildings.

(c) Semi-portable Streams from Department Water Towers.—These excellent devices which raise the nozzle from the ground the equivalent of three or four stories bring said stories into the realm of effective service of an outside stream, and for this purpose the pressures required must be increased some 25 to 40 lbs. to overcome the head from this higher elevation at which the tower nozzle is discharged and the friction in the apparatus.

(d) Streams from Metal Standpipes and Roof Hydrants on Nearby Buildings.—We regard this class of service as offering excellent opportunities, and would advise that street fronts of buildings in congested city districts at intervals not exceeding 100 ft. be fitted with 6-inch standpipes with metal ladders attached; a siamese to be provided at the bottom near sidewalk level with two 3-inch hose inlets and a check valve in each; with a 3-inch hose outlet and independent control gate at each 20 ft. in the height of standpipe and with two hose outlets each with independent gate at top of hydrant near roof level. All of these standpipes to be tested at 300 lbs. pressure at street level by the Fire Department, at least once a year, and a law enacted making it a misdemeanor for anyone without permit from the Fire Department to alter or impair this standpipe service.

Upon response of the Fire Department, connection should always be made by hose from the nearest high pressure hydrant to the base of standpipe, ready to be put in operation if needed. Metal universal joint nozzles for direct connection with the standpipe outlets should be carried by the department and one or two attached at the outlets at proper level on the standpipe most advantageously situated. Such a standpipe thus fitted, upon arrival of the department, would rival a water tower in efficiency and constitute a vantage point from which streams could be discharged without the immediate presence of firemen who might find the position untenable due to heat or smoke, and yet the pipe and its outlets could be under the control of the hydrant man at the high pressure hydrant several hundred feet distant.

With exposure fires threatening buildings from the rear, streams could be connected up to the roof hydrant outlets carried over the roof, and used to excellent advantage from such a location.

This class of service requires high pressure due to height of buildings as at present erected. There is, however, some reasonable limit in height of buildings beyond which it should not be required to extend the public fire service, thereby taxing all for the excessive wants of a few. These latter should provide their own fire protection, build and occupy so as to be non-combustible, or, where the building laws are lax enough to permit such conditions, go without protection and perhaps without insurance. Such buildings are at present infrequently located, and the burning out of the tops of such pinnacles should not seriously menace lower surrounding buildings.

We could, therefore, consider 100 ft. above grade as a fair limit of height for full service of a high pressure system. This limit would require, using round figures, a maximum of 225 lbs. pressure at hydrant, viz., 75 lbs. for nozzle pressure, 100 lbs. for friction loss in hose and pipes and 44 lbs. equivalent to the standpipe head.

(3) Exposure Sprinklers, Commonly Known as Open Sprinklers.—Systems fitted with these sprinklers are now being developed to an efficient state where ample water supply and pressure can be found with which to supply them. Our proposed high pressure fire service systems would constitute an ideal water supply for them and would be connected up to a siamese inlet as above described for the standpipes.

We are inclined to recommend this procedure, rather than permanent metal piping, fearing the valves in the latter might be operated by property owners in event of a wide spreading fire, and promiscuous and extended use of such systems would not only mean the application of water where it was not needed, but bleed even the best of high pressure services, possibly to the point of exhaustion.

So far as pressure is concerned, that which would be adequate for the standpipe service would properly serve the exposure sprinklers.

To properly supply the several services, pressures must be maintained at the hydrants as follows (using round figures):

Inside hose streams, 1¼-in. nozzle, 400 ft. 2½-in. good hose, 25 lbs nozzle pressure, 75 lbs.

Inside standpipe streams (two in use) through two 400 ft. siamesed lines, 3-in. hose, 100-ft. 6-in. vertical pipe, 100 ft. 2½-in. hose, 25 lbs. nozzle pressure, 1¼-in. nozzle, 100 lbs.

Automatic sprinkler system, two 400 ft. lines, 3-in. hose, 100 ft. vertical 6-in. pipe, 200 ft. horizontal 6-in. pipe, 25 lbs. maintained flowing 1,000 gal. per minute, 160 lbs.

Ground hose streams, 75 lbs. nozzle pressure, 2-in. nozzle, two 400-ft. siamesed 3-in. hose lines, 175 lbs.; 1¼-in. nozzle, 75 lbs. nozzle pressure, 400 ft. 3-in. hose, 140 lbs.

Standpipe stream, 2-in. diameter universal nozzle attached to top of 6-in. standpipe 100 ft. above ground, 75 lbs. nozzle pressure maintained, two 400 ft. siamesed 3-in. hose lines, 225 lbs.; two streams attached to roof hydrant on 6-in. vertical pipe 100 ft. above ground, 1¼-in. nozzles, 2½-in. hose, each line 100 ft., 75 lbs maintained at nozzles, the standpipe fed through two 400 ft. siamesed 3-in. hose lines, 225 lbs.

Water Supply.—We have above indicated the water pressures necessary for efficient fire fighting, and will now refer to the amount of water which should be provided, capable of all being discharged at not less than the pressures above specified.

We would first call attention to a feature we note in water works or other reports as to the amount of water consumed for fire purposes. It is customary in water works phraseology to speak of the discharge per 24 hours. Few fires last so long a time. It is necessary that sufficient water be supplied to feed all the outlets put in service at one time, and we will here speak of the quantity desired per minute, the unit employed by the fire protection engineer.

In fighting city fires there are two situations to be taken into consideration—the local fire and the

conflagration. The former is represented by a fire in one building or a few contiguous properties either in one block or on opposite sides of alleys or streets. It is reasonable to direct efforts and provide apparatus and water supply with the intention of extinguishing such a fire. The amount of water to be provided for local fires will depend upon the area of the buildings, the occupancy, height, depth and construction, and also upon the barriers existing in the way of fire walls, wire, glass, shutters and exposure sprinkler protection at window openings, and on openings, and on open areas; in other words, upon the amount and location of the combustibles.

In providing quantity of water for a high pressure service under the least exacting conditions, we would recommend as a minimum for local fires some 18, 1¼-in. streams, 7, 2-in. streams, which are equal to 7,500 gallons per minute discharge at the required pressures. For the most exacting local fire requirements, we should judge as adequate discharge under the conditions named of 20,000 gallons per minute, which is the equivalent of 50 1¼-in. streams, or 20 2-in. streams.

The second condition for which we have to provide is the fire which has spread beyond control and developed into what is termed a "conflagration." It must be understood that buildings as they now exist in our cities, crowded with vast quantities of combustibles, without adequate separation by fire walls, and without suitable window protection, present conditions which allow fires therein to extend absolutely beyond human control. Nevertheless, there it at such times a great work to be done by the fire department in following up and limiting the spread of such a fire, in fighting it on its side boundaries and at the rear and in the prevention of back fires and extinguishment of distant fires originating from flying fire brands. For this purpose, we advise a reserve increasing the quantities above specified from 50 to 100 per cent., conditioned upon the extent and nature of such conflagration district.

For how long a period shall water be furnished to these outlets? Baltimore burned for the greater part of two days. Other historic conflagrations have been of longer duration. Where provision is to be made for a conflagration service, it would seem reasonable to indicate as a minimum available quantity of water an amount which would supply the service in its full efficiency for a period not less than 36 hours.

It is needless to report a gravity service, which fulfills the requirements here set forth, as most desirable. It will mean a service constantly maintaining a high pressure, but normally throttled by gate valves for the use of the first few hose streams which will control and extinguish the large majority of fires. Pumping plants with power from steam, electricity or gas are also practical for this purpose, the customary reasonable precautions being taken as to fireproofing of buildings, freedom from interruption of service, either in respect to power, pumps or water supply; and the use of multiple units so that a single break or state of repairs will have but little effect upon the whole. Where available, the providing of connections for use of sea water as a reserve supply is to be recommended and will doubtless frequently be availed of as providing complete assurance of a water supply without limit in event of adverse contingencies.

No unusual conditions are to be met in the distribution system, simply the use of the proper specifications for heavy pressure pipes, hydrants, hose, nozzles and holders, which are all now commercial realities. Special care must be exercised in the planning of the gridiron system, the use of properly laid pipe of suitable size so as not to cause a drop in pressure of any importance, due to friction loss while delivering at any point in the system the full amount of water there required under the pressure conditions specified. The well-established practice is to be noted of placing gate valves where the gridiron crosses at all street intersections, that short lengths of piping not exceeding one block could be at any time cut out, leaving the rest of the system in complete service.

In view of the usefulness of these systems for "first streams" and the desire to keep them in operation for fire purposes at all times, it is advisable that they be not used for any other purposes, such as street flushing.

Once such a system is properly installed, its efficiency will largely depend upon its careful maintenance, checked up by organized tests and examinations, all of which should be gone into most carefully and reported upon frequently, using detailed report blanks for such purpose.

Such a high pressure system is a tool of the Public Fire Department, who are responsible for fire fighting and the results attained; hence, the control of such a system should be in the hands of the Fire Department, thus contralizing authority and responsibility. This will naturally require the employment of engineers of high intelligence and ability.

Attention is called to the urgent need of bettering the fire fighting facilities in many cities, due to the present deficiency of water supply, both in pressure and quantity, and the shortcomings of the present steam fire engines and other equipment service.

General Requirements.—A high pressure system must of itself, without the intervention of steam fire engines, at all times be capable of furnishing a supply of water adequate both in volume and pressure for the local needs and uses.

Such a service shall be comprehensive enough to supply hose streams used within a building, either those brought in by the Fire Department or attached to standpipes; also automatic sprinkler systems; hose streams directed from the ground without the building which is on fire, whether held by hand or by mechanical attachments and whether stationary or portable; it shall also properly serve outside streams directed from metal standpipes, roof hydrants, water towers and exposure sprinklers.

Aside from such exceptionally large discharge orifices which might be employed on water towers, we suggest for general hose stream use, smooth bore nozzles of 1¼-in. to 2-in. diameter hose of not less than 3-in. diameter for street use; hydrants frequently enough located so that all of the water required at any one building can be there discharged without the use of hose lines longer than 400 feet. The hydrants to be used for this purpose should all be located within 250 to 300 feet of the building to be protected.

We suggest 100 feet above grade to be considered the maximum height for which full public fire service need be provided; that buildings exceeding this height be required to have non-flammable construction or occupancy, or equipped with automatic sprinklers and other fire appliances, provided by proper independent water supplies.

Maximum pressures in the street main necessary for such services vary from 100 lbs. to 225 lbs., and must be provided for.

Devices for holding the nozzles of semi-portable hose streams are advised.

The development of outside standpipe service along the lines indicated is strongly urged.

The required capacity of the water supplies at the pressures indicated should range according to conditions in individual cities from 7,500 gallons to 20,000 gallons per minute for local fires, and 50 to 100 per cent. additional for conflagration fires; these quantities to be provided for not less than 36 hours' constant service.

We deem such systems practicable, of decided advantage for certain places and recommend their introduction.

Legal Engineering Notes.

The Missouri-Illinois Case over the pollution of the Mississippi alleged to be caused by the Chicago drainage canal was advanced another stage on May 29, when Commissioner Frank S. Bright made his final report to the U. S. Supreme Court. He was appointed to take testimony in the case, and his record of 7,975 printed pages, or 4,480,000 words, is stated to be the most voluminous ever deposited with the court.

The Diversion of Water by a municipal riparian owner was the subject of a recent decision of the Connecticut Supreme Court of Errors in Osborne v. City of Norwalk. The opinion is summarized in 60 Atl. Rep. 645 as follows: "The diversion of water from a stream by a city for use for municipal purposes is not warranted by the city's riparian ownership of the land at the point of diversion, where its beneficial enjoyment of the land is in no way promoted thereby. No increase in the amount of water permanently diverted from a stream can be lawfully obtained by a riparian owner by the stoppage of leaks of long standing in a dam at the point of diversion, to the prejudice of other riparian proprietors, although such repairs are necessary to maintain the efficiency of the dam."

Defective Water Supply for extinguishing a fire was the cause of a case recently tried before the Tennessee Supreme Court. The decision is summed up in 85 S. W. Rep. 897, as follows: "Where a water company agreed to supply at all times an amount of water sufficient to extinguish fires, its failure to do so, resulting in the destruction by fire of property within the contemplation of the contract, was the proximate cause of the loss. Where a water company contracts to supply at all times an amount of water sufficient to extinguish fires, and a loss results from the burning of property covered by the contract, due to its failure to furnish water, the measure of damage is full indemnity for the loss resulting from the breach, and not merely the value of the water which should have been furnished under the contract."

A Street Grade Problem that deserves attention recently arose in Kittanning, Pa. In 1894 the borough established a system of grades for the streets differing but slightly from the natural surface grades. Most of the pavements and sidewalks laid since then have conformed to the established elevations, although a few have been laid on the natural surfaces. Last year a building was erected on one of the latter streets, to conform as to height with grades given by the borough engineer. When the building was completed, the owners undertook to elevate the sidewalk in front of it to the established grade, which was 8 in. above the existing sidewalk at one end and 31 in. at the other. Although this elevation would make the sidewalk dangerous, the owners of the building insisted on their right to do so, and the city was forced to carry the case to the Pennsylvania Supreme Court to settle the matter. That court has just ruled as follows, 60 Atl. Rep. 584: "Where a borough establishes a paper grade of a street, it confers no right on an abutting owner to elevate his sidewalk above the natural grade to conform to the paper grade so established; and, where the proposed sidewalk would be a dangerous public nuisance, the construction of the same will be enjoined on a bill filed by the borough. Where a borough council permits a contractor, in the construction of a building, to adapt it to a pavement that might at a future time be constructed at an established paper grade, it has no authority to raise the sidewalks to such proposed grade."

The Reconstruction of the Continental Trust Building, Baltimore.

The Continental Trust Company's building, at the southeast corner of Baltimore and Calvert Sts., Baltimore, Md., is a sixteen-story, modern, steel-cage office building about 100 ft. square, with a 40x50-ft. open light court in the middle of the south side. It was of steel cage construction with closed rectangular columns supporting the walls at every story; the floorbeams and girders were flush top and bottom and were thoroughly protected by the 16-in. hollow-brick, flat-floor arches; the columns were fireproofed with hollow tile blocks. Five stories were faced with granite, the remainder of the street fronts were of brick with terracotta trimmings; the rear walls were of common brick and the court walls were of common brick faced with gray pressed brick. The elevator screens and the stair frames were of cast and wrought iron, and the stairs cast iron with treads of marble. Interior partitions were of 4-in. and 5-in. hollow tile up to a height of 7 ft. above the floors in the corridors and above that were of wood glazed. All the office floors, doors, window sash and trim were of wood and the outer windows were not wire glazed or provided with steel shutters. D. H. Burnham & Co. were the architects and Charles McCall was the contractor. The building was completed in 1903 at a cost of about $1,100,000 and most of the rooms were occupied.

In the great fire of February 7 and 8, 1904, the building was exposed to intense heat on the Baltimore and Calvert Sts. sides and the flames, driven by a fierce wind, entered through the upper story windows, carrying large quantities of live coals, and nearly all the woodwork, glass, marble, furniture and combustible contents of the building were destroyed, and much of the cast iron, plaster, and thin tile partitions above the first story were badly damaged. The exterior granite and terracotta were very badly injured, and most of the enameled brick facing was loosened, but comparatively little damage was done to the roof and floors, and practically none to the solid brick walls or the steel framework. The main structure was thus left substantially uninjured, as described in The Engineering Record of Feb. 20, 1904, and thoroughly demonstrated the ability of a modern steel-cage building to resist great heat and serve as a barrier to external fires. This quality did not, however, safeguard the contents or finish of the building, and the condition of the latter, the character and extent of reconstruction needed and the method of making it are the subject of this article.

Old Walls Not Yet Removed, August 15, 1904.

A general contract for all repairs, refitting and reconstruction was awarded to the Thompson-Starret Co., of New York, and proved to be about equivalent to the construction of a new building after the steel framework and floors only are built, plus some repairs to the floors and exterior walls. Much of the rubbish had been removed and partitions had been taken down, and some necessary work done on other portions of the building, before the contractors commenced operations, so that apparent discrepancies between the statements of existing conditions made in this article and those descriptive of the immediate effects of the fire can be reconciled by the explanation that the former are as observed by the contractor's superintendent, and the latter as hastily noted or estimated immediately after the fire.

The contractor took possession of the building July 11, and first completed the removal of the plaster and rubbish in the differnt stories. In the second story about one-third of the plaster was injured and above the second story all of the plaster, trim, window, doors and wood floors were gone and no partitions were standing except in the sixteenth story. About 95 per cent. of the floor arches were standing, with the cinder concrete filling above them in apparently normal condition and the wooden screeds bedded in it to receive the floor boards entirely consumed. The plaster and tiling had sufficed to protect the steelwork from injury by the heat even in most places where it had subsequently been detached. The mosaic floors in the toilet rooms were uninjured except by some cracking, and only required patching to restore them. All the halls had marble floors, which were calcined and destroyed, apparently by the fierce blast of hot air, as there was very little combustible material in the halls to cause flames. The ceilings were plastered directly on the arch tiles with hard, patent mortar, which was generally calcined and loosened, but still served as a shield against the flames. The cast-iron work of the stairways was not materially injured, and about 80 per cent. of the marble treads were still serviceable, although so much defaced that they were replaced.

On the exterior of the building the white-face brick were greatly damaged by the heat and were useless, being friable and broken. The mortar appeared to have been cement and lime mixed, and it was practically destroyed by the heat. The face bricks were not bonded with the wall, but were attached to it with thin galvanized iron anchors, which pulled out of the backing and allowed the face brick to separate from the walls in large sheets, most of which, however, remained standing. On the Calvert St. front, which was exposed to the fiercest heat, the only brick facing was in the piers between the windows of the upper eleven stories; the remainder of these stories was faced with terracotta, which suffered the least of all the front walls and was in such good condition that in nine stories it was allowed to remain, requiring repairs in occasional places only.

On all outer walls, except Calvert St., everything was stripped from the steel framework from the cornice to the middle of the third story, thus removing 1½ stories of the granite facing. On Baltimore St. about 30 per cent. of the granite in the lower four stories also had to be removed, and on Calvert St. three-fifths of all the granite was removed and it was taken down to street level at the rear corner, but in all cases the brick backing was found in good condition.

All cast-iron mullions, spandrels and window frames were removed with the brickwork. Most of the mullions in the light court were badly sprung, often being bent in S shape and broken. They were originally fastened to 7-in and 8-in. horizontal channels bracketed out from the wall girders. These channels were many of them badly bent and twisted, and in some cases were straightened and put back.

For removing the face granite, scaffolds were built up from the ground to the fifth story, as seen on the Calvert St. front in the photographs of August 15 and October 18, and the sidewalk beneath them was protected by a heavy roof. On the rear side cantilever beams were projected from the windows and supported platforms at every story. From each of them inclined chutes were successively built of wood and canvas, covering the entire face of the wall and delivering inside the building to the next floor below. The framework for these chutes is seen in many places in the photograph dated August 15, and there appears like knee bracing for the

cantilever beams. In the court and other walls all work was done from Foster scaffords suspended by wire ropes from the top of the building to the fifth story, as shown by the photograph of Sept. 21. Work was in progress removing the old walls from the upper tiers of scaffolds only at any given time. As many unskilled laborers as could find room on the scaffolds started at 3 a. m., by lantern light, and worked until 8 p. m., stripping the framework at a maximum rate of three stories in two days. The brickwork was pulled off by hand and chuted inside the building, where it was sorted and the good bricks cleaned and piled for use again. The debris and all rejected materials were delivered by an outside vertical chute from the different stories to three cars provided daily on a special siding of the Pennsylvania R. R., which was laid close up to the building for this purpose.

The columns and wall girders were stripped and all exposed metal was thoroughly cleaned with wire brushes. It was found to be in excellent condition and was painted one heavy coat of red lead and linseed oil. The walls were then rebuilt exactly as for a new building.

The new work was rebuilt according to the original plans, except that the cast-iron mullions were replaced by brick piers and in the rear the window heads and sills were made with rowlock arches and stone sills to save time. Much trouble and delay was occasioned by the difficulty of replacing damaged terracotta blocks, as it was generally necessary to take down a whole story or pier to remove a single piece and bond another properly in its place.

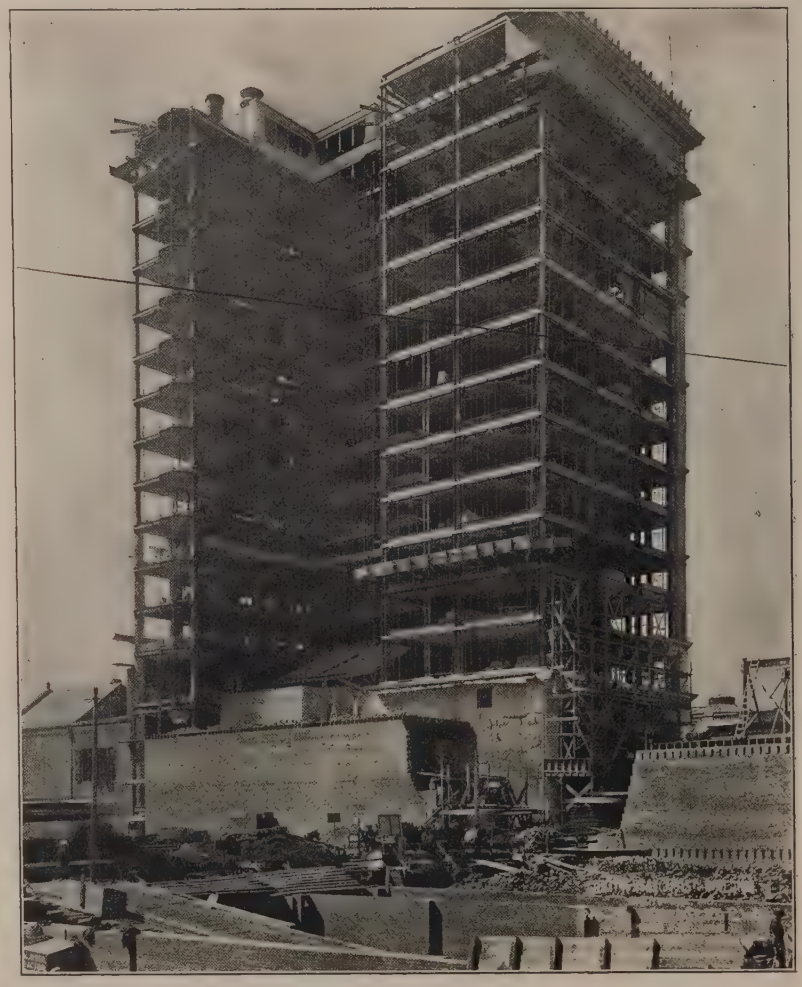
All floor arches were of the National Fireproofing Company's standard construction, of about 6-ft. span, made with hard tile, end construction flat arches filled up with 4 in. of cinder concrete in which were embedded 1-in. screeds covered by ⅞-in. tongue and groove floor boards or by the tile and marble surface already mentioned. The general condition of these floor arches was considered very good, and wherever repairs were necessary they were made and the floors restored to the original standard. In the third and fourth stories the bay window rooms had wood-paneled walls and ceilings, and this excess of combustible material was apparently the cause of special injury to the arches in the floors above where the under sides of the tiles were entirely destroyed. The injured tiles, however, still possessed sufficient strength to support the floor and these arches did not fall. In another place where the bottom surface of the arch tiles was gone, they still retained so much strength that the floor span sustained a concentrated test load of 600 lbs. of sash weights without any perceptible deflection or cracks.

All the floors in the building were tested by passing over them, parallel with axes of the arches, an iron roller weighing 160 lbs. per linear foot. The roller was as long as the arch span and was rolled between the beams so that the arch sustained its full weight. The axle projected several inches beyond the roller at each end, so that in case of the arch collapsing it would engage the floorbeam on each side and be prevented from falling through the floor into the story below, but in no case did the arch fail under the test. Large areas of the fourth floor appeared to be unbroken, and endured the roller test, but when examined seemed to be unsound and were removed and replaced. All the floor arches which were used for storing materials or for walking on were temporarily covered with a layer of boards to protect the tiles from impact and help distribute the loads until they were repaired and concreted. Several thousand square feet of new arch tiles were purchased for renewals, and when it became impossible to get more delivered in time, concrete was used instead for floor slabs. The concrete was hand-mixed wherever needed and was made, for the main slab, 1:3:5 with 1-in. broken stone and Northampton Portland cement supplied by C. S. Goss & Co., New York. The same cement was also used for the cinder concrete filling and for the 1:3 mortar used for patching. Considerable difficulty was found in obtaining cinders for the concrete and some were imported from other cities, because the great demand exceeded the decreased amount produced in Baltimore.

Where the floor arch tiles were uninjured, except by the loss of the bottom surface in lengths of 5 ft. or less, the arches were considered safe and were repaired simply by wire lathing and plastering the lower sides. Single defective tiles were generally not removed, but were filled in and 4 in. thick, and were continued to the ceiling with woodwork and glazing.

Although the old floors had withstood the loads from the safes in the offices, provision was made in the reconstruction for special reinforcement under the safes weighing 7 tons or more. The concrete above the arches was made with stone instead of cinders in these places, and was reinforced by 2½x2½-in. T-bars, horizontal web down, spaced about 6-in. apart and reaching across three floorbeams.

None of the main steel framework of the building was found damaged or needed repairs except three of the floorbeams and the light wall channels in the court. In one place a panel of the floor arches was in position and appeared sound. They had protected the floorbeams from the flames, yet the latter proved to have sagged 4 in.



Old Walls Removed and Scaffolds Ready for New Walls, September 21, 1904.

place solid with cement mortar. If more than one block in a span was damaged, the whole set from beam to beam was removed and replaced by new tiles or by a strip of concrete.

The roof construction was like that of the floors, but lighter, and was found in good condition except that the tar and felt with which it was covered was buckled up and had to be all stripped off and replaced. Most of the steel and copper skylight frames were destroyed and new ones were put in their places. The floor repairs were made simultaneously with the rebuilding of the outer walls and after they were completed the partitions were built, and carpentry, plastering, glazing, painting, metal and marble work and all other finishing was executed as in the original construction of a new building. Partitions were built to a height of 7 ft. with National Fireproof hollow terracotta blocks 3 in. and had to be removed and straightened.

Reconstruction was fairly under way about the middle of July, and was practically finished about February 1, although the work was considerably delayed by strikes and hampered by the impossibility of getting building materials rapidly enough or in sufficient quantities. Especial difficulty was experienced in securing terracotta, of which there never was enough on hand for a full day's work. Other material was therefore substituted for it as much as possible. Most of the labor was paid at the rate of $1.25 a day, and the pay roll amounted to over $2,000 a week.

The reconstruction was executed in accordance with the architect's plans and specifications and was in charge of Mr. C. S. Neale, superintendent for the contractor, to whom acknowledgment is made for the data for this description.

A Failure of the Waring Small-Pipe Sewerage System.

Over twenty years ago, when the late Colonel Waring was prominent in municipal engineering work, there was a great controversy over his strong recommendation to use 6-in. pipe sewers in streets. At the time, this journal strongly opposed the use of a pipe of this diameter as a street sewer in a city of any size, and it claimed that any such system of small sewers would inevitably prove inadquate. The proof of this assertion has recently been given by Judge Letton, of the Supreme Court of Nebraska, in Shannon v. City of Omaha. On account of the engineering importance of this decision, in which the other judges concurred, it is given here in full:

View of New Outer Walls of the Continental Trust Building, October 18, 1904.

This action was brought to enjoin the collection of certain special assessments against the property of the plaintiffs, levied for the purpose of defraying the cost of the construction of a sewer on Capitol Ave., from Twelfth to Sixteenth Sts., in the city of Omaha. In 1882 a sewer district was created by ordinance, known as "Sewer District No. 6," and comprising Capitol Ave., from Ninth St. to Twentieth St., the sewer beginning at Ninth St. on the east, and flowing to Twelfth St., and beginning at Twentieth St. on the west, and flowing thence to Twelfth St., in which street both of these lateral sewers emptied into a main sewer running at right angles thereto. It appears that in 1882 the city authorities adopted a drainage plan for the city known as the "Waring System." Col. Waring was a sanitary engineer of wide reputation and high standing in the profession at that time, who had carried out successfully a plan of sanitary sewerage in the city of Memphis, in which he used for laterals 6-in. pipes. When the city authorities of Omaha were about to install a sewerage system, they called in Col. Waring, and adopted a complete plan and system for the city, prepared by him. The then city engineer, Mr. Andrew Rosewater, was not in favor of the Waring system, and testifies that, in his judgment, it was not a practicable system, on account of the liability of the 6-in. pipes to become blocked up by sticks and other obstructions; but the city council, evidently relying on the high reputation of Col Waring as a sanitary engineer, adopted his system in spite of Mr. Rosewater's objections.

At the time the sewer was constructed, that portion of Capitol Ave., between Twelfth and Sixteenth Sts., was occupied mostly by small residences, but soon afterwards a number of business buildings were erected on this portion of the street; among them being the Dellone Hotel (a large, five-story modern building), the W. R. Bennett store, the Presbyterian Hospital, and the Exposition Building. At least three hydraulic elevators were installed in these buildings, and water closets, with sewerage connections, were put in place. The increased amount of water thus cast into the sewer was such that the 6-in. pipe between Twelfth St. and Sixteenth St. was not sufficient to carry it off, and the result was that the water from the sewer repeatedly backed up into the manholes and flooded the basements of the hotel, hospital and the Bennett store; rising high enough upon one occasion to put out the fires in the boiler room of the hotel, and requiring the use of the city fire engine a number of times to pump out the basements. The testimony showed that the use of hydraulic elevators throws at times large quantities of water into the sewer, and that the use of three elevators at the same time discharged into the 6-in. sewer a larger quantity of water than it could carry away.

From Twentieth St. to Sixteenth St. there is a steep hill, and the rapid flow of that portion of the sewer seems to render a 6-in. pipe sufficient to carry off the sewage upon that portion of the street, but a large outlet was necessary on the comparatively level ground from Sixteenth St. to Twelfth St. In 1887, in order to remedy these defects, the city council created a new sewer district, known as "District No. 211," comprising that portion of Capitol Ave. from Sixteenth St. to Twelfth St., and constructed a sewer therein 24 in. in diameter, instead of 6 in. as before, connecting with the 6-in. pipe at the foot of the hill on Sixteenth St. Since the construction of this sewer there has been no further trouble with the drainage of that portion of Capitol Ave. The plaintiffs paid the taxes assessed against their property for the construction of the 6-in. sewer, but resisted the collection of the taxes for the 24-in. sewer.

The plaintiffs contend, first, that the city engineer knew in 1882, when the first sewer was laid, that it was insufficient; that he was opposed to its construction, and that the city, regardless of this knowledge, accepted an imperfect plan and constructed a worthless sewer; that the city was negligent in so doing; and that to attempt to assess the cost of a second sewer, under such circumstances, upon the abutting property, is unreasonable, oppressive and void. We think there is little merit in this contention. In fact, we are inclined to think that the defective construction of the sewer of which plaintiff complains was brought about by an excess of caution on the part of the city authorities. So careful were they to obtain the best obtainable system, that they disregarded the advice of their city engineer, and sought to obtain the benefit of the skill of one of the most renowned sanitary engineers of the United States. They did what, in their judgment, was for the best interests of the city, when they employed a man with a reputation as an expert in that line. It is true that they might better have taken the advice of their own engineer, for the future defects of the system were not foreseen, except by him. When the city council, misled by the glamour of a great name, employed Col. Waring, they did what any prudent, cautious business man would have done under like circumstances, and the plaintiff cannot complain if their judgment was erroneous. The authorities cited by the plaintiffs are to the effect that a city is liable for injuries caused to a property owner by reason of its negligence in devising a defective plan, and in constructing an improper drain, creating a nuisance; but in this case, as we have seen, the city was not guilty of negligence. It exercised the highest care under the circumstances.

The plaintiffs further contend that since that portion of the sewer between Sixteenth and Twelfth Sts. received the accumulated sewage of the district between Sixteenth St. and Twentieth St., the city was without authority to assess the entire cost of the large sewer made necessary by this discharge upon the property between Twelfth St. and Sixteenth St.; and it is argued that, since the property owners from Sixteenth St. west to Twentieth St. derived some benefit from the enlargement of the sewer from Twelfth St. to Sixteenth St., they should pay a portion of the cost of the same. They urge that, since the construction of the first sewer, a number of boarding houses and other buildings have been erected between Sixteenth St. and Twentieth St.; that consequently an increased amount of sewage has been cast into the 6-in. pipe to the west of Sixteenth St.; that this has rendered a larger sewer necessary between Twelfth St. and Sixteenth.; and that therefore a part of the increased cost of the large

sewer should be borne by the territory west of Sixteenth St. The evidence shows, however, that the 6-in. pipe between Twelfth St. and Sixteenth St. was large enough to carry off the sewage coming down the hill until the business buildings were erected between Twelfth St. and Sixteenth St., and afterwards except during business hours, when the hydraulic elevators and closets were being used; that for about seven hours each day the sewer was insufficient, but during the remainder of the time its capacity was enough; and there is no evidence of any clogging of the 6-in. sewer west of Sixteenth St. at any time. The great fall at that portion of the sewer caused it to clear itself.

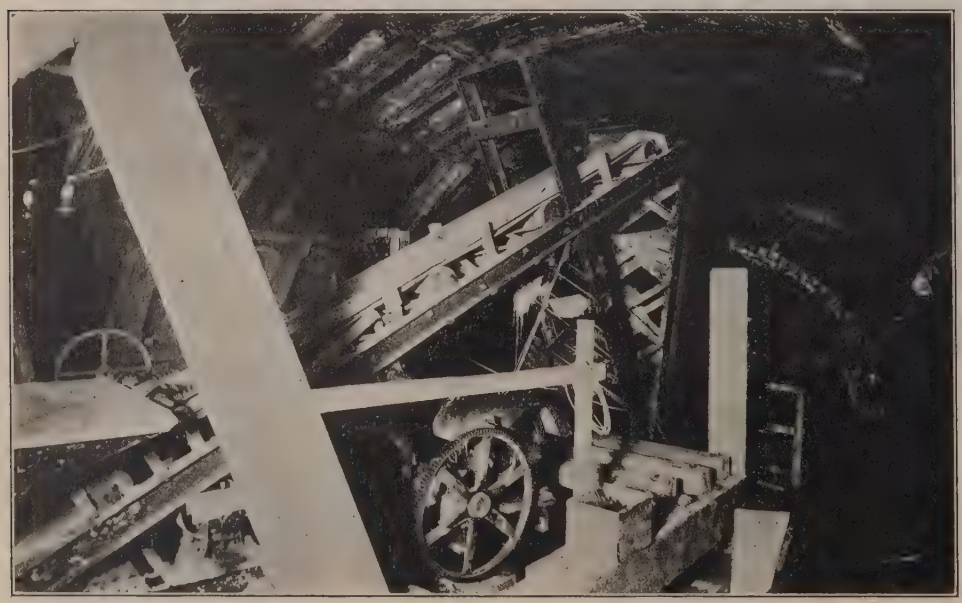
It is apparent that the trouble largely arose from the increased use of the sewer within the new district. Under these circumstances, we think there was nothing arbitrary, excessive, or unjust in assessing the cost of the sewer to the abutting property between Twelfth St. and Sixteenth St. according to special benefits. It is impossible to accurately ascertain and adjust with mathematical certainty the special benefits which any particular piece of property receives by virtue of the construction of an improvement such as a sewer. The most that can be done is to ascertain approximately the special benefits received by each particular tract, and, unless the result of the assessment is excessive, arbitrary, or unjust, it will not be disturbed.

We think there is no force in the argument that, when a city has once assessed the cost of a special improvement, it cannot, at a later period, when changing conditions and increased growth have brought about a larger necessity, create a new improvement, and assess the same against the property benefited, for the reason that the owners have already paid for one improvement. Such a holding might have the effect of continuing a condition which might suit a small town or city, and yet be totally inadequate to the requirements of a modern city of 100,000 inhabitants. The power is a continuing one, and may be exercised whenever the public need demands it. With the growth of the city, its need has grown. The improvement sufficient for 1882 was not sufficient for 1897. From the 1897 improvement the plaintiffs' property was benefited, and it should bear its just proportion of the burden, measured by the special benefits it received.

The First Street Tunnel, Washington.—II.

After the excavation is completed the invert and side wall foundations up to the offsets are made in one operation. The concrete is mixed by two Smith machines installed in the tower at the south end of the tunnel as described on Sept. 10, 1904, and is delivered in 1-yd., side-dump steel cars drawn by the mine electric locomotives used for the spoil cars. The stone center wall is then built, steel moulds are set up and the outside walls are built as described Sept. 17. For this work a special traveling tower is used which has a stiff-leg derrick mounted on each of the front corners. The tower practically consists of two longitudinal trusses connected by top transverse struts so as to give a clearance of 9 ft. vertically and about 11 ft. horizontally through the lower part for cars on the main track. The traveler derricks have very short masts and booms with special fittings designed to require the minimum clearance for the blocks and to afford as wide a radius as possible under the arch timbering. The fixed sheaves are set between steel plates arranged to allow the greatest possible clearance. Two 6x1-in. bent steel plates are bolted to the end of the boom to form a goose neck fitting close under the arch timbers and practicallly extending the radius and height of hoist. These derricks are operated by two Mundy hoisting engines driven by 25-h.p. General Electric motors seated on the upper deck of the traveler, and have a capacity of about 5 tons each, although the maximum loads are only about 4,000 lb. Their booms are so short that they have to be frequently moved to keep abreast of the stone laying and do not place the steel moulds for the concrete side walls which are more advantageously set in advance by hand. This traveler working about 10 hours daily is able to build the masonry walls at a rate of 70 ft. per week, as fast as the other parts of the work progress.

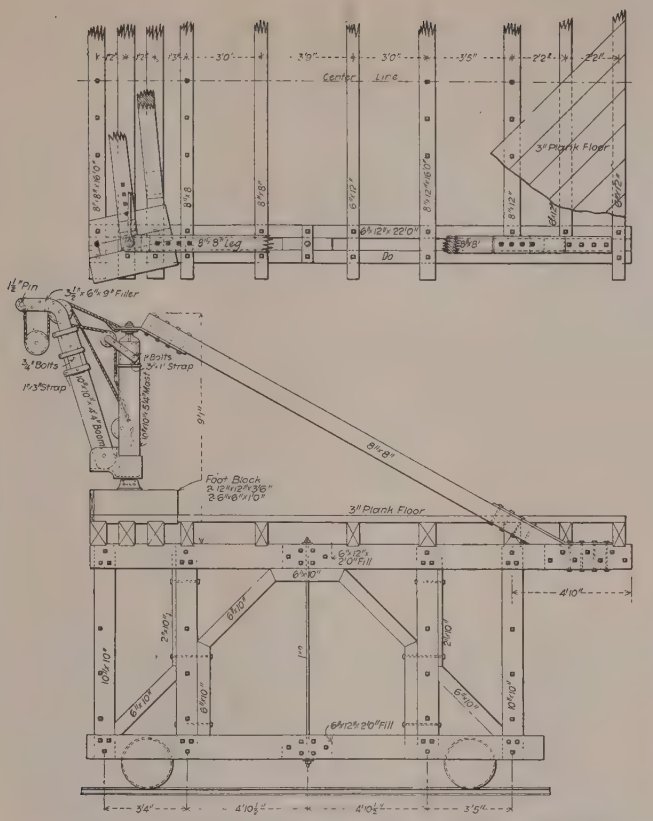
Derrick Traveler Handling Concrete for Side Walls.



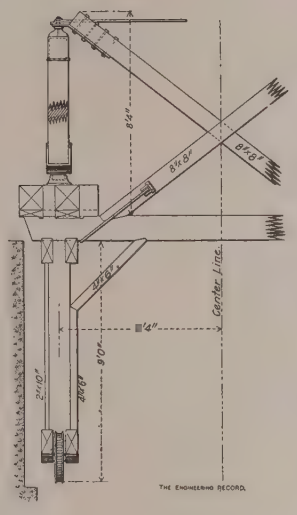
Cantilever Belt Conveyor Handling Concrete for Backfilling.

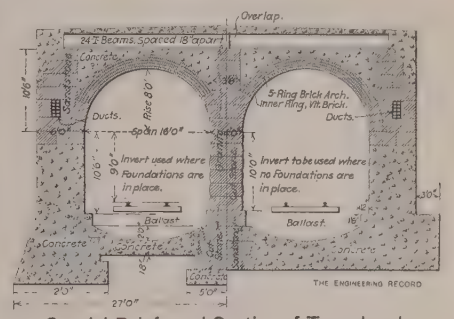
The derrick traveler is followed on the same 14-ft. gauge track by another traveler with a 16x20-ft. tower about 10 ft. high with clearance through it longitudinally for the cars and locomotives. It carries a section of arch centering 20 ft. long with ribs 4 ft. apart and 2½x4-in. lagging which is wedged up to level and alignment, and after the arch is built is released by slacking the wedges and is moved forward without taking down. The 20-ft. section of full-centered arch is built in 10 hours. The brick arch is usually kept about 200 ft. in the rear of the steam shovel and about 100 ft. from the derrick traveler.

Before the centering is removed from the arch section a conveyor traveler which is always kept between the derrick tower and the centering, is moved back to the forward end of the brick arch and delivers all the back filling required to fill the spaces between the brick arch and side walls and the timbering, which includes about 4 yds. of concrete haunch filling, and the regular backfilling of gravel, all thoroughly rammed in place. The conveying and hoisting apparatus is mounted on a tower similar to those for the derricks and arch centering and moving on the same track. It has a deck the full width of the tunnel and 29 ft. long on which is mounted at the front end a stationary hoisting apparatus and at the rear end a cantilever swinging conveyor. Concrete is delivered from the outside mixers in 1-yd. Cyclopean buckets, the same as for the side walls, which are lifted through an opening in the end

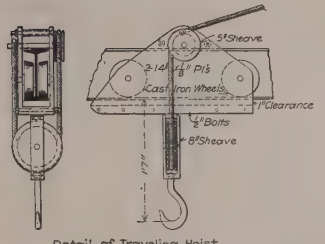


Derrick Traveler for Building Masonry.

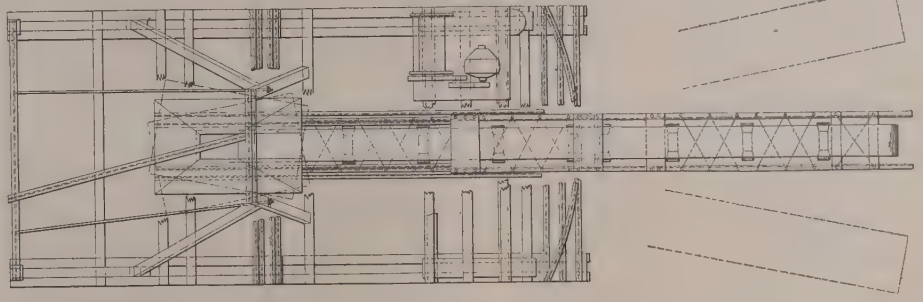


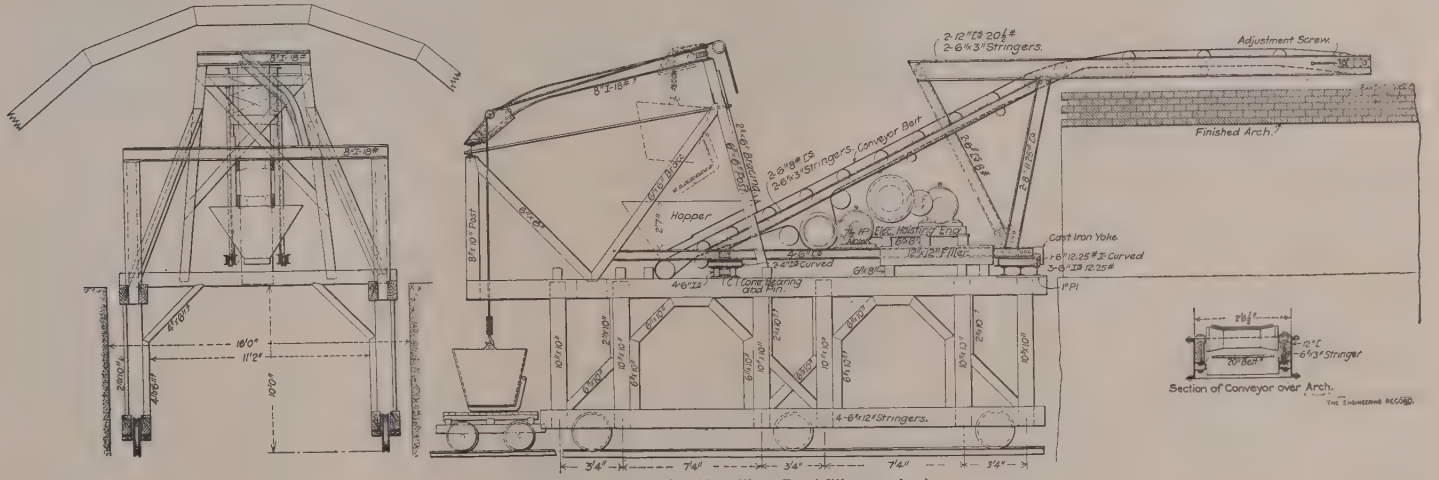


Special Reinforced Section of Tunnel under Office Building.



Detail of Traveling Hoist.





Conveyor Traveler for Handling Backfill over Arch.

of the deck by a trolley hoist operated by a Lambert hoisting engine on deck, driven by a 15-hp General Electric motor. The trolley and hoist line are rigged so that when the bucket rises to the trolley the latter is released and is pulled by the hoist line to the upper end of an inclined curved I-beam where it stops close to the tunnel roof timbers, and is dumped by hand. The contents are received in a steel hopper of 30 cu. ft. capacity, which is mounted on the conveyor frame. The conveyor frame has a pair of triangular trusses about 21 ft. long, 9 ft. high and 3 ft. apart which are pivoted to the center line of the deck near the forward end and revolve through a short horizontal arc supported on a curved I-beam track at the rear end of the deck. The trusses and cantilever support a 20-in. conveyor belt which, contrary to usual practice; is driven at a point some distance from one end so as to afford more room and protection to the mechanism. The face of the driving wheel is covered with rubber to give it maximum adhesion and the belt is held in contact with it for about 180 degrees by two idlers. Stretch is taken up and tension maintained by a pair of adjustment screws at the end of the cantilever. The belt was purchased from the Webster Mfg. Co., and is operated by a 7½-h.p. Crocker-Wheeler motor. The steel work was made by the Alexandria Iron Works, of Alexandria, Va., and the apparatus was designed and assembled by the contractors. A 6x18-in. opening in the bottom of the receiving hopper is commanded by a sliding gate operated by a rack and pinion with a hand wheel at the upper part of the hopper. The belt is driven at a speed of about 180 ft. per minute and has a capacity much greater than the 10 yds. per hour of concrete or sand which it delivers above the brick arch and is as much as the men there can ram into place. The apparatus requires only two men to operate it and is considered to save the work of about twelve shovelers.

It requires about 8 hours to back fill the concrete above the brick arch for one side of the tunnel, and after it has set 12 hours it is waterproofed by four layers of felt and hot asphalt protected by a single course of bricks laid flat in

cement mortar. About 4 yd. of gravel per lin. ft. is rammed between the concrete and the arch timbers and crown bars and completes the tunnel construction.

All concrete is mixed and timber framed in the contractors' yard at the south end of the tunnel, where the plant remains the same as described in The Engineering Record of Sept. 7, 1904, except for the addition of an Ingersoll-Sergeant air compressor and a set of storage and loading bins for delivering the muck to wagons. Operations will soon be commenced on the open cut work at the north end of the tunnel and perhaps also on the driven tunnel work there and will necessitate the establishment of a yard and plant at that point. At the north end of the driven tunnel a single-track electric car line passes over the tunnel close to the brick arch, and must be independently supported before excavation is commenced there for about 350 ft. Two longitudinal rows of piles are being driven to clear the outside wall of the tunnel, one on each side of the car track, and will support needle beams under the track, enabling the latter to be undermined at convenience and finally seated on piers built on the tunnel roof. The piles will not interfere with the tunnel construction except that holes will be left for them to pass through the brick arch. After the track is supported on the tunnel arch the piles will be removed and the holes filled up. The tunnel has been designed and its construction is being carried on under the supervision of the Pennsylvania Railroad Co., Mr. W. H. Brown, chief engineer, Mr. Robert Farnham, Jr., assistant engineer. The contractor for the work is the New York Continental Jewell Filtration Co., Mr. C. L. Parmelee consulting engineer, and Mr. E. G. Williams, resident engineer.

Erection of the Walnut Street Long Span Girder Bridge, Philadelphia.

The double tracks of the Pennsylvania R. R. freight line elevated railway are carried over the Walnut St. city bridge, Philadelphia, on a bridge with a main trussed span and two through plate girders, which have pin-bearing shoes and pedestals seated on stone piers. The piers clear the city bridge, and as there are two electric car tracks in the street, and it was necessary not to obstruct the west-bound one nor interrupt the vehicular traffic in the street, special methods were devised for erecting the long, heavy girders which were delivered on trucks in the street.

The viaduct was erected up to the Walnut St. crossing by an overhead traveler with two 70-ft. steel booms of 40 tons capacity, rigged with four-part tackles of ⅞-in. steel rope, both operated by a four-drum Lidgerwood hoisting engine. The traveler was advanced to the Walnut St. pier and set on it the pedstals with the shoes connected ready to receive the girders. A small, movable derrick set the pedestals in place on the opposite pier and the traveler picked up from the ground beside the viaduct, where it had been assembled, a framed gallows frame made of 12x12-in. timber, lifted it clear of the fence, swung it over the city bridge and set it up in a vertical transverse plane parallel with the plane of the axis of the viaduct in such a position that its legs cleared the west-bound street car track and permitted traffic on both sides of it. The obstruction of the east-bound track was permissible because it is only used by the electric cars on days when there are special celebrations or exhibitions at Franklin Feld, or for emergencies.

The gallows frame was guyed in opposite directions by four 1-in. steel cables attached to the ends of the cap, and adjusted by four-part tackles anchored to the ground. From the reinforced cap, 18 in. wide and 36 in. deep, a four-part steel rope tackle was suspended just inside each leg and their lower blocks were shackled to the ends of a pair of 15-in. I-beams about 8 ft. long, provided at the center with heavy plate hooks. One pair of guys was slacked enough to allow the cap of the gallows frame to overhang the feet about 3 ft. and be in the plane of the girders, to the top flange of which the hooks were secured and locked by through bolts. The fall lines of both tackles were led to two capstan heads of a hoisting engine on the curb and the girder was easily lifted about 20 ft. and seated on its shoes. The traveler boom moved the gallows frame about 20 ft. transversely and the same method was followed in the erection of the second girder, the first one having been securely braced before being released from the gallows frame. The floor-beams and bracing were then assembled between the girders by the traveler booms, which also removed the gallows frame, and after the span was completed moved across it to continue the erection of the viaduct. The girders were built at the Pencoyd shops of the American Bridge Co., of New Jersey, Mr. Paul L. Wolfel chief engineer, and were erected by the American Bridge Co., of New York, Mr. S. P. Mitchell, chief engineer, and Mr. H. F. Lofland, manager of the eastern division.

Erection of Walnut Street Girders with Gallows Frame.

Connecting the elevated railway west of the Schuylkill River on Market St. with the subway east of the river, the Philadelphia Rapid Transit Co. has built a four-track bridge, with one sidewalk, over the Schuylkill River. This has a total length of about 563 ft. and comprises a channel span of about 214½ ft., two side spans of 90 ft. and 98 ft., and two plate-girder approach spans. The side and channel spans, each having four trusses, were erected on ordinary falsework, supported on piles. The double-boom traveling derrick used on the Walnut St. span described above was also used on this bridge.

The traveler was erected on shore just west of the west abutment and facing eastward. The four lower plate girders, the heaviest of which weighs 18 tons, were first erected, and immediately afterwards the floor system was assembled. The four elevated railway girders were then lifted from the cars and placed temporarily on the outside trackways. The traveler then moved on and erected the west side span, afterwards moving ahead out of the way. The four girders for the elevated railway could not be handled by the traveler, and so two gin poles were arranged for their erection.

Each gin pole consisted of a 12x12-in. yellow pine stick 35 ft. long, set with the top about 5 ft. out of plumb and overhanging the girder, and held back by three back guys and one front guy attached to shackles lashed to the top of the stick, which was not cut or bored. Each back guy was a five-part Manila tackle, and the front guy was a single line anchored at the bottom and attached to a five-part tackle at the top. The five-part hoisting tackle had wide plate hooks engaging the top flanges of the girders, and were operated by the same hoisting engine, care being taken to keep both fall lines uniform. These girders weighed about 13 tons each, and one of them was erected in about 25 minutes by a gang of 20 men.

In erecting the trusses for the channel and side spans the lower chords were assembled on the camber blocking their entire length and connected at each end with the shoes. The traveler was then moved back and the floor system, vertical posts and diagonals and the inclined end posts were set in position and bolted to the connecting plates on the lower chords, which gave them sufficient stability to stand upright without additional bracing until the upper chords could be put on. The lower lateral system of bracing was added as the lower chords progressed and the upper system after the top chords were in place.

The falsework which supported the traveler, material, track and camber blocking consists of independent trestle bents with a 48-ft. central open panel, spanned by 16 lines of 20 in. I-beams.

The bridge was built and erected by the contractors who erected the Walnut St. span, and the work was executed under the direction of the engineering department of the Philadelphia Rapid Transit Co., Mr. W. S. Twining, chief engineer, and Mr. C. M. Mills, principal assistant engineer.

The Design of Reinforced Concrete Beams.—II.

By George H. Blakeley, M. Am. Soc. C. E.

For the investigation of a beam already designed when the bending moment M_O is known or the moment of resistance, M, is to be limited and A_s or n, the area or percentage of steel also being given, to find C_1 and S it is necessary first to determine the value of x in the following manner. The ratio between the moduli being denoted by m, then

$$m = \frac{E_s}{E_c'}.$$

Substituting in Equation (11) the value of $\frac{S}{C_1}$, obtained from equation (13), and reducing

$$x = \left[\sqrt{\frac{m\,n}{q} + \left(\frac{m\,n}{2\,q}\right)^2}\right] - \frac{m\,n}{2\,q} \qquad (18)$$

With this value of x and knowing the value of M the stress C_1 in the concrete will be obtained from equation (14) and likewise the stress S in the steel obtained from equations (15) or (16). The ratio m is a function of C_1 which is unknown. A value for C_1 can be assumed and an approximate value of the ratio m taken to correspond with the equivalent modulus for the assumed stress. The value of x thus obtained from equation (18) will be closely approximate, as x does not vary rapidly. If the stress C_1 obtained from equation (14) with this approximate value of x differs considerably from that assumed then a recalculation of x will be necessary, using a revised ratio of m corresponding to the approximate value of C_1 found from the first calculation. Values of x corresponding to equation (18) for 1:2:4 and 1:3:5 stone concrete may be taken from the diagrams in Figs. 9 and 10, in which the values of x are plotted for various percentages of steel and for different intensities of stress in the extreme element of the concrete.

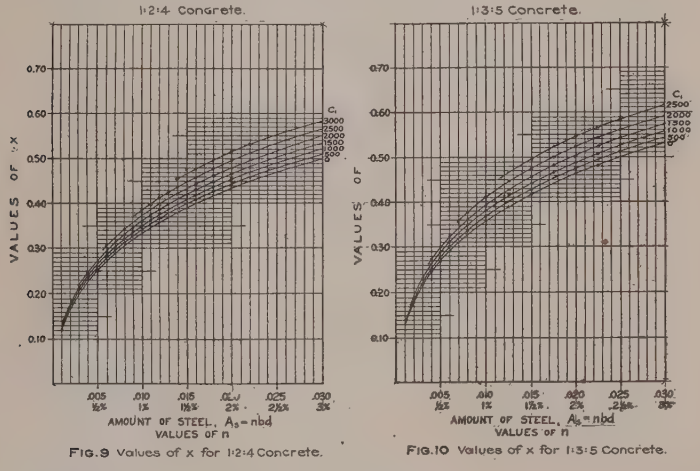


FIG. 9 Values of x for 1:2:4 Concrete.

FIG. 10 Values of x for 1:3:5 Concrete.

Diagrams of great convenience for rapid design or investigation, similar to those shown in Figs. 11, 12, 13 and 14, may be prepared giving values of K for varying intensities of C_1 and S for the quality of concrete to be used. The calculation of such diagrams will be facilitated by proceeding in the following manner: For the same stress in the concrete the values of m and q in equation (18) will remain constant; then with a variable n, or percentage of steel, find the resulting values of x, which, substituted in equation (14), will give values of K for a uniform stress of C_1 corresponding to the various percentages of steel assumed. In this manner a sufficient number of results may be obtained from which to draw the curves of values for K as shown in the diagrams corresponding to stresses of $C_1 = 500$, etc., for varying percentages of steel. Similarly for an assumed stress in the steel find x from equation (11) with C_1 as the variable, also the corresponding n from equation (13), and with these values of x and n in equation (16) obtain the resulting value of K corresponding to the assumed intensities of stress in the steel and concrete for the percentage of steel reinforcement found to be required. A sufficient number of results may be obtained in this way from which to draw the curves of values for K shown in the diagrams, corresponding to stresses in the steel of $S = 15{,}000$, etc., for varying percentages of steel. The diagrams in Figs. 11, 12, 13 and 14 were derived in this manner for 1:2:4 and 1:3:5 Portland cement concretes. Figs. 11 and 12 are diagrams at working stresses for reinforcement with medium steel and hard steel, showing values of K with the corresponding stresses in the steel and concrete, and the factor of safety. Figs. 13 and 14 are diagrams for K at various stresses in the concrete within the ultimate and also for stresses in the steel within the elastic limit of the latter, for both hard and medium steel.

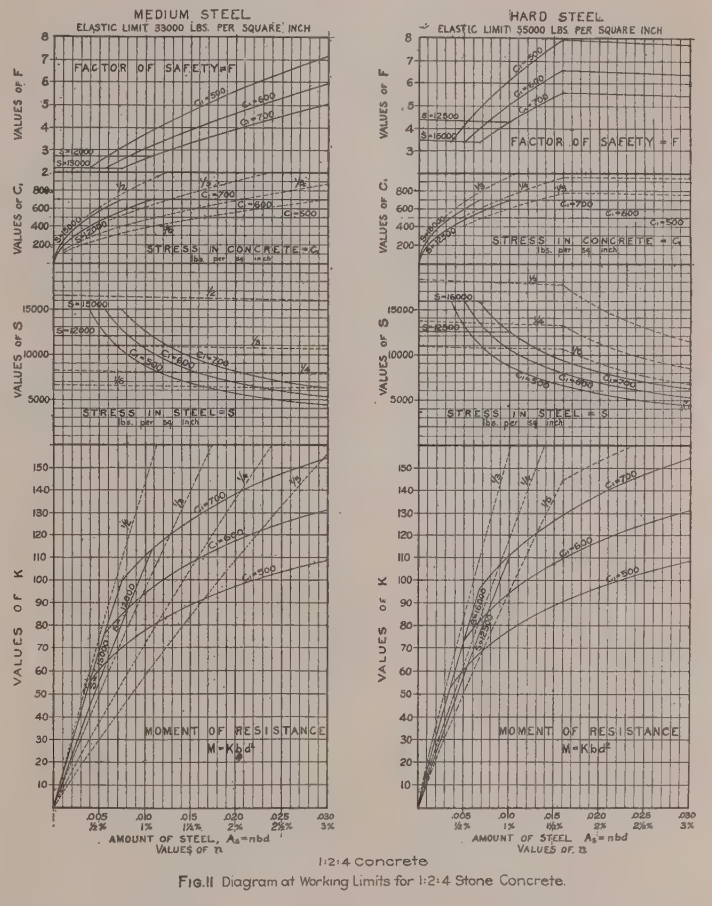


FIG. 11 Diagram at Working Limits for 1:2:4 Stone Concrete.

Transverse failure of the reinforced beam, neglecting the question of shearing strength, is caused either by the crushing of the concrete in compression or by the failure of the steel in tension. Steel stretches very rapidly after the elastic limit has been exceeded, the concrete on the tension side cracks badly, and failure of the beam takes place when the stress in the steel does not greatly exceed the elastic limit. For practical purposes, therefore, the ultimate transverse strength is determined by the elastic limit of the steel, in case the latter is reached before the crushing strength of the concrete is developed on the compression side of the beam. The elastic limit of medium steel is assumed to average 33,000 lbs. per sq. in. and 55,000 lbs. per sq. in. for special hard steel bars. The broken lines marked ½, ⅓, etc., in Figs. 11 and 12, represent values of ½, ⅓, etc., those at the elastic limit of the steel or at the crushing strength of the concrete, depending upon which condition governs. These lines accordingly represent values having a factor of safety of 2, 3, etc., within the elastic limit of the steel or within the crushing strength of the concrete as the case may be. Owing to the uncertain strength of concrete it is advisable to use a greater factor of safety for it than for the steel. If it is decided to use a factor of safety of 4 for the steel, then it is advisable not to strain the concrete more than ⅙ of its ultimate. Thus for 1:2:4 concrete, with medium steel, referring to Fig. 11, the values of K for steel reinforcement of less than 1.14 per cent will be given by the line ¼ and by the line $C_1 = 500$ for greater amounts of steel.

Some applications of these diagrams are illustrated by the following examples, referring to Fig. 12 for 1:3:5 concrete:

(1) With 6/10 per cent reinforcement of medium steel and limiting the stress in the steel to 15,000 lbs. per sq. in. by inspection of the diagram find $K = 80.5$, the stress in the concrete $C_1 = 575$, and 2.2 the factor of safety.

(2) With 1½ per cent medium steel reinforcement and limiting the stress in the concrete to 500 lbs. per sq. in. by inspection of the diagram find $K = 94.5$, the stress in the steel $S = 7{,}400$, and 4.3 the factor of safety.

(3) A beam in which $b = 12''$ and $d = 6''$ is to safely support a uniformly distributed load of 2,700 lbs. on a span of 8 ft.; find the amount of steel required.

$$M_O = \frac{2{,}700 \times 96}{8} = 32{,}400 \text{ inch lbs.}$$

$$K = \frac{M_O}{bd^2} = \frac{32{,}400}{12 \times 36} = 75.$$

If the stress in the concrete is not to exceed 500

lbs. per sq. in. the diagram shows that for the given value of K the amount of steel required = 0.73 per cent = .0073 bd = 0.53 sq. in.; also that the stress in the steel is 11,300 lbs. per sq. in. and the safety factor is 2.9 of the ultimate strength of the beam. If, however, the beam is to have a safety factor of 4 then the amount of steel required will be obtained by reference to the line ¼ and will be 1.06 per cent = .0106 bd = 0.76 sq. in.

When some of the bars are bent upwards near the ends for shearing, the point at which the bending may take place without diminishing the transverse strength of the beam can be found from these diagrams. Thus in a 1:2:4 beam with 1 6/10 per cent medium steel reinforcement, if the stress in the concrete is limited to 600 lbs. per sq. in. and a factor of 4 is to be preserved within the elastic limit of the steel, by referring to Fig. 11, K = 109.5 for the full amount of steel in accordance with the first condition. If half the number of bars are bent upwards, then for the remaining bars, or 8/10 per cent. reinforcement, K = 58, in accordance with the second condition. The theoretical point at which half the number of bars may be dispensed with in tension in this instance and bent upward for shear is, therefore, where the bending moment is reduced in value to $Mo = 58\ bd^2$, but it is well to extend the bars beyond this theoretical point in the same manner as is done with flange plates on a plate girder.

By means of the diagrams, Figs. 13 and 14, the stresses in existing or proposed work are readily investigated when the loading is known and the percentage of steel given. From the given load find the bending moment in inch lbs., then

$$K = \frac{Mo}{bd^2}.$$

With the known percentage of steel plot this value of K and the stresses in the concrete and steel are at once approximately indicated by the diagrams. For example, a 1:2:4 concrete beam with 1 per cent medium steel reinforcement supports a load producing a bending moment of 120 bd^2, in which case K = 120; then plotting this value of K for 1 per cent of steel in Fig. 13 the stress produced by the assumed loading is indicated to be about 760 lbs. per sq. in. in the concrete and about 13,700 lbs. per sq. in. in the steel.

A comparison of the observed loads at failure of the reinforced concrete beams tested by Prof. Hatt and Prof. Talbot with the ultimate loads deduced from the theoretical analysis here proposed is given in the following table, in which unity represents the theoretical ultimate if analyzed by the proposed method. The maximum, minimum and average of the experiments are given.

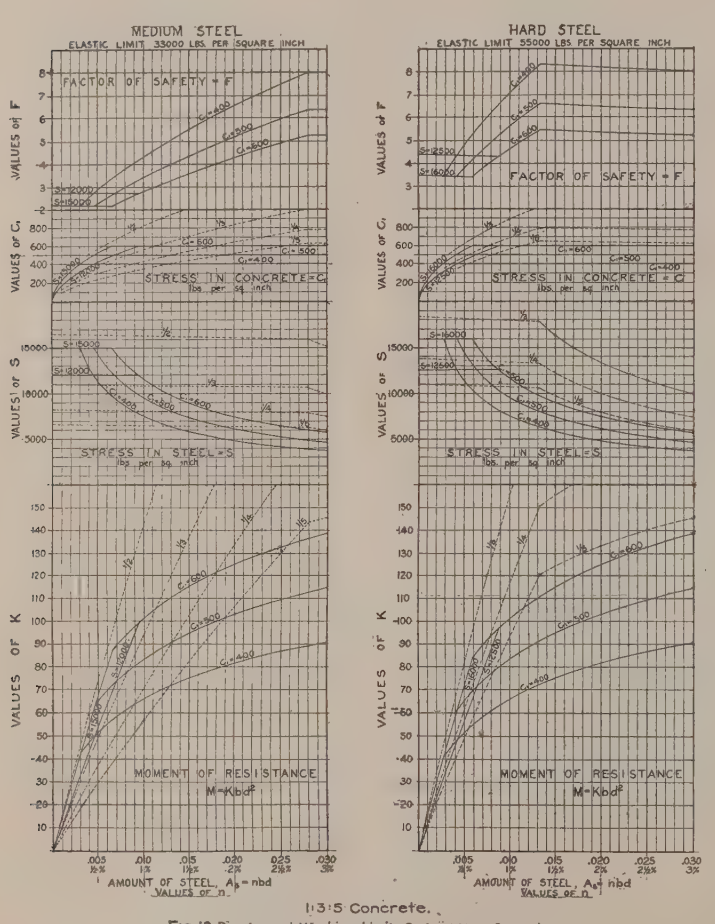
	Max.	Min.	Average.
Hatt:			
1:2:4 concrete:			
Medium steel plain bars.	1.20	1.03	1.06
Talbot:			
1:3:6 concrete:			
Medium steel plain bars.	1.22	1.04	1.07
Hard steel cor. bars....	1.08	0.96	1.02

While the load at failure in some of these tests was as much as 22 per cent more than the ultimate strength indicated by the proposed method of analysis, yet on the whole the average loads at failure were only from 2 per cent to 7 per cent greater. The ultimate load given by the formulas is that producing a stress in the steel of its elastic limit, at which the concrete cracks badly and the total serviceable strength of the beam has been attained for all practical purposes, but the beam will sustain a load 5 per cent to 10 per cent greater than this before final failure occurs. When this distinction between the theoretical ultimate load and the final load at failure is considered the proposed formulas are in satisfactory agreement with the results of these reliable and impartial tests of Prof. Hatt and Prof. Talbot.

An inspection of Figs. 13 and 14 shows that unless the amount of steel reinforcement is considerable the ultimate strength will be determined by the elastic limit of the steel, a consideration which is frequently neglected by experimenters. With a small or moderate amount of reinforcement it is essential that the elastic limit of the steel in the beam on which the test is made should be known. For satisfactory comparison of experimental results in such cases an exact knowledge of the actual elastic limit of the steel employed in each test is more essential than the determination of the physical properties of the concrete.

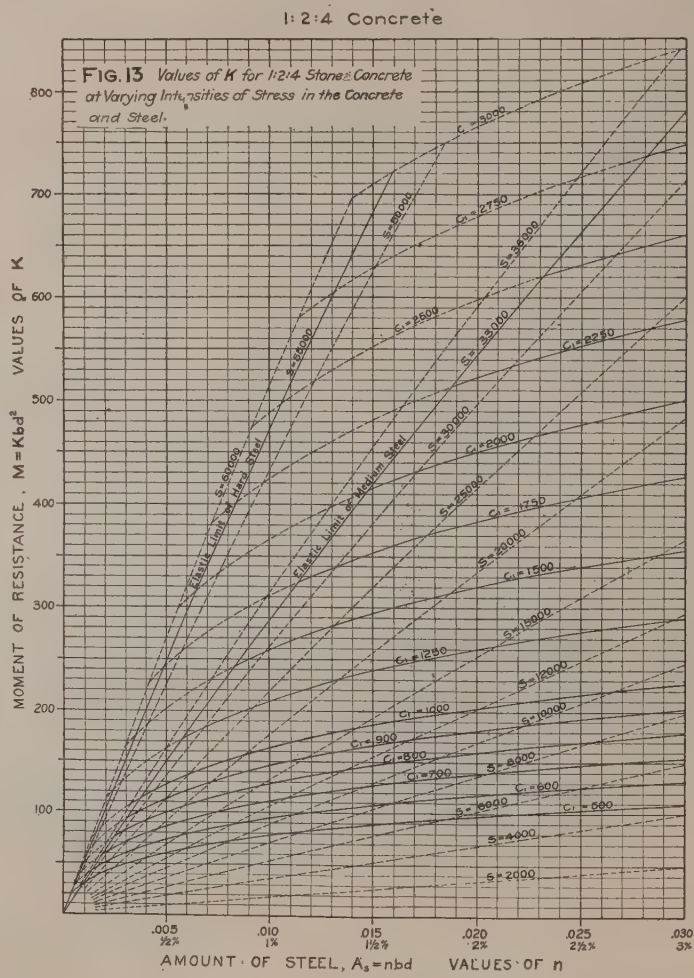
An inspection of Figs. 13 and 14 shows that the stress in the concrete is not proportional to the loading, which effect is due to the change in form of the compressive stress diagram. Thus, in Fig. 14 for 1:3:5 concrete with 1½ per cent hard steel, K = 620 as the crushing strength of the concrete of 2,500 lbs. per sq. in. For a load ⅕ this ultimate K = ⅕ × 620 = 124, which value of K the diagram shows to correspond to a stress of 650 lbs. per sq. in. in the concrete, instead of 500 lbs. per sq. in., which would be expected if the stress in the concrete were proportional to the loading.

Within the limits of allowable safe loads it will be noted that the compressive stress diagram of the concrete is nearly a triangle and might be so considered for practical purposes without much error, in which case q = ½, also r = ⅔, and these values of q and r may be substituted in the equations given for transverse strength, simplifying them in form for use in the approximate calculation of safe loads when the stress in the concrete is small.



1:3:5 Concrete.

FIG. 12 Diagram of Working Limits for 1:3:5 Stone Concrete.


1:2:4 Concrete
FIG. 13 Values of K for 1:2:4 Stone Concrete at Varying Intensities of Stress in the Concrete and Steel.
MOMENT OF RESISTANCE, M=Kbd²
VALUES OF K
Elastic Limit of Hard Steel
Elastic Limit of Medium Steel
AMOUNT OF STEEL, As = nbd
VALUES OF n

The ultimate shearing strength of Portland cement stone concretes is about one-tenth the compressive strength. If V represents the ultimate shearing strength per sq. in., then from equation (7)

$$V = 450 - 25f.$$

A liberal margin against shearing should be provided and at the working load of the design a factor of safety of at least 5 should be used. It is essential that the end shear in the cross-section of a beam or slab at its supports should not exceed the safe allowable shearing strength. If R is the end reaction or end shear and v the safe shearing stress per sq. in., then for safety against shearing it is necessary that

$$vbd > R.$$

It is further evident that the stress is delivered to the steel by longitudinal shear in the concrete in the horizontal plane of the reinforcement. The intensity of this longitudinal shear is a maximum at the ends of the beam and should not exceed the safe shearing strength of the concrete. To determine this shear take the bending moment at a distance d, equal to the depth of the beam, from the end. Find x from equation (18) or from a diagram and then from equation (15) find the total stress SA_s in the steel. This stress must be delivered to the steel by longitudinal shear in the concrete in the distance d and therefore for safety against shearing it is required as a further condition that

$$vbd > SA_s.$$

When diagrams are constructed similar to Figs. 13 and 14 this operation can be expedited. With sufficient accuracy,

$$K = \frac{R}{bd},$$

and using this value of K the stress per sq. in. in the steel, or S, is obtained from the diagram, which, multiplied by the area of the steel, gives the total stress developed in the distance d from the end of the beam to be absorbed by shearing in the concrete in the same distance. In the case of short spans heavily loaded where these shearing limits are exceeded, special provisions in the reinforcement will be necessary, by bending up some of the steel bars at the ends or by other means.

The formulas and constants of this article relate to Portland cement stone concretes, but they can be applied to the analysis of Portland cement cinder concrete with due regard to the smaller crushing strength of the latter. The few tests made on cinder concretes show a wide range of crushing strengths, much seeming to depend on the kind of cinder used, also upon the method of mixing and making. For good average work the following are suggested values of the properties for use in analysis:

$$C = 2{,}400 - 200f$$
$$E_0 = 1{,}200\,C$$
$$E_c' = E_0 - 600\,C_1.$$

These equations are similar to those proposed for stone concretes, but they give smaller values for the same proportions of mixture when cinder filling is used. The initial modulus and the equivalent modulus, E_0 and E_c', are the same functions of the crushing strength as those proposed for stone concretes, consequently q and r will have the same values and variation within the crushing strength as already determined and may be taken from the table of their values previously given for stone concretes, from which diagrams similar to Fig. 6 may be constructed. The formulas already given will then apply to the analysis of reinforced cinder concrete beams simply by using the proper values of the variables corresponding to the properties of the concrete employed. A 1:2:5 cinder concrete is much used and for which, from the foregoing, $C = 1{,}000$ and $E_0 = 1{,}200{,}000$. With these values and the values of q, r and m corresponding the formulas already given are used in the analysis. Diagrams giving values of x and K similar to Figs. 9, 11 and 13 may be constructed for various percentages of steel and varying intensities of stress in the steel and concrete. Values of K for 1:2:5 cinder concrete at various stresses in the concrete within the ultimate and also for stresses in the steel within the elastic limit of the latter are shown by the diagram, Fig. 15, which may be used for convenience in the design or investigation of such cinder concrete beams in the manner already explained.

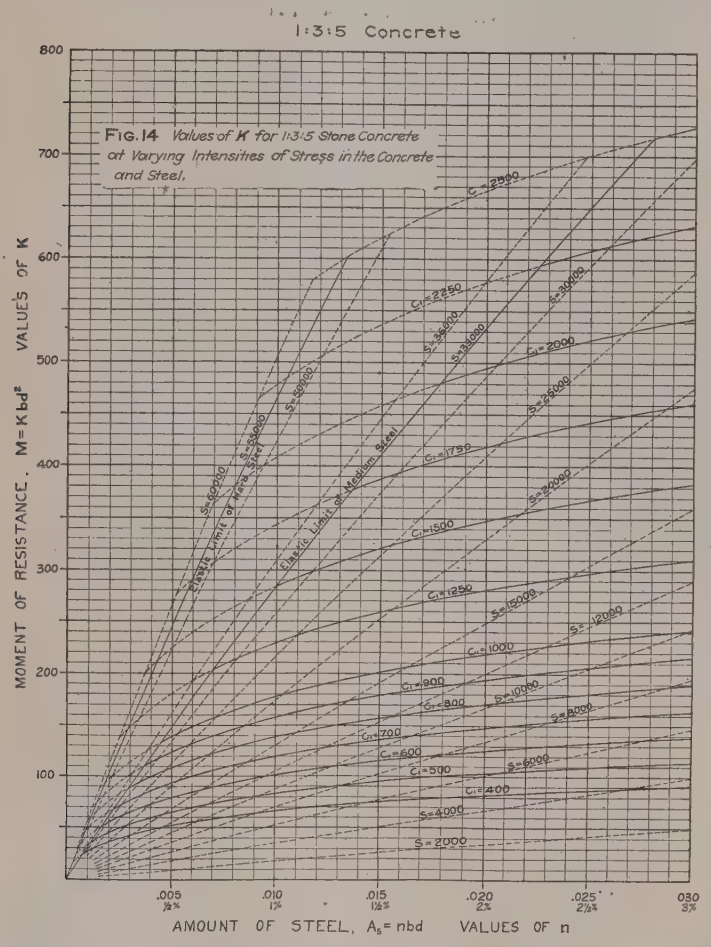

1:3:5 Concrete
MOMENT OF RESISTANCE, M=Kbd² VALUES OF K
AMOUNT OF STEEL, As=nbd VALUES OF n
Elastic Limit of Hard Steel
Elastic Limit of Medium Steel

FIG. 14 Values of K for 1:3:5 Stone Concrete at Varying Intensities of Stress in the Concrete and Steel.

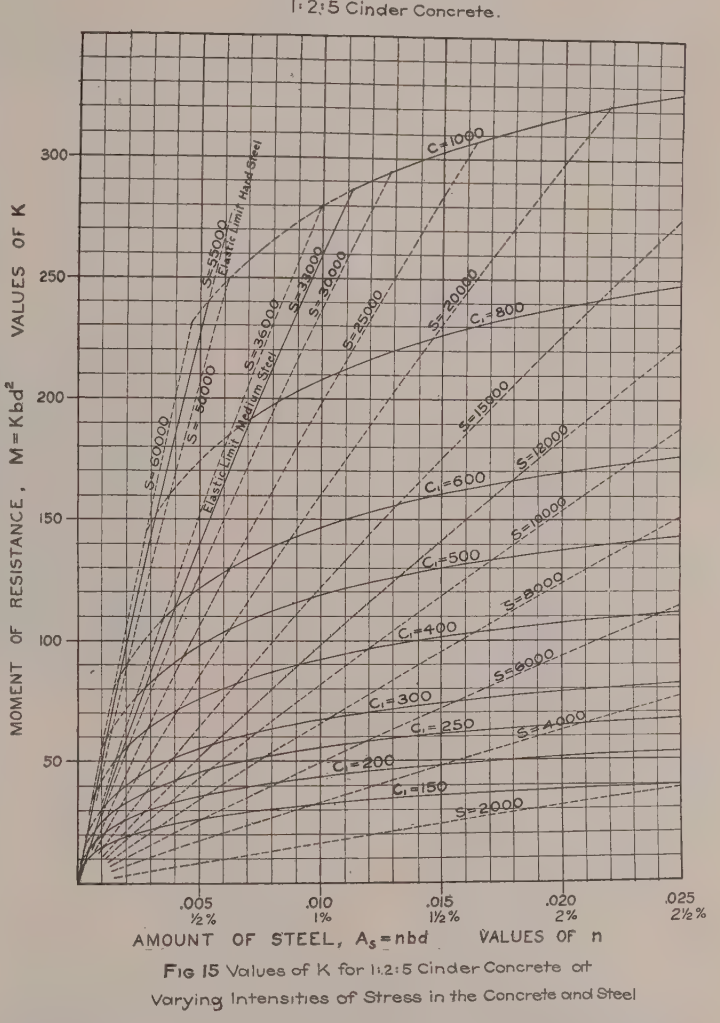

1:2:5 Cinder Concrete.
MOMENT OF RESISTANCE, M=Kbd² VALUES OF K
AMOUNT OF STEEL, As=nbd VALUES OF n
Elastic Limit Medium Steel
Elastic Limit Hard Steel

FIG 15 Values of K for 1:2:5 Cinder Concrete at Varying Intensities of Stress in the Concrete and Steel

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THE NEW INTAKE TUNNEL of the Detroit waterworks has been completed and the contractor, the C. H. Fath & Sons Construction Co., of Cleveland, is now engaged in sinking the river shaft. The tunnel has an inside diameter of 10 ft. and is lined with four rings of vitrified brick laid in Portland cement mortar. It is 4,225 ft. in total length, the distance between the shore and river shafts being 3,160 ft. The greatest depth of water is 30 ft., at which point there is 26 ft. of clay between the bottom of the river and the top of the excavation. The material penetrated has been an impervious blue clay, with occasional small pockets of sand. The heading was advanced at a rate of about 400 ft. a month with an average air pressure of 18 lb. No shield was used, and there was no loss of life or serious accident. The work was planned and has been supervised by Mr. Clarence W. Hubbell, civil engineer of the Detroit Water Board, and will probably be completed late in the summer.

The Cantilever Erection of the St. Joseph Drawbridge.

The St. Joseph & Grand Island R. R. crosses the Missouri River at St. Joseph, Mo., on a five-span bridge, which includes a draw span 357 ft. 8 in. long, with a single track between the trusses and a roadway cantilevered from the trusses on each side. It replaces an old structure with spans of the same length on the same substructure which carried both roadways and railroad track on the same floor which was planked over continuously between the trusses. The new bridge was built and the old one was removed without interfering with the frequent train service or stopping the considerable highway traffic, but did not maintain navigation at all times under the draw span. For the erection of the three 297½-ft. fixed spans pile falsework was driven between the piers, the old structure was blocked up on it, the trusses removed and the new ones erected while traffic was supported on the old floor, and finally the latter was removed and the new floor assembled panel by panel. The falsework piles were driven by a special machine having leads suspended from the horizontal top chords of the old through trusses, and the trusses were erected by a three-bent tower traveler clearing old and new trusses.

The interesting features of the work were due to the difficulties encountered in erecting the east arm of the draw span, concerning which Mr. S. P. Mitchell, chief engineer of the American Bridge Co., of New York, which was the contractor for the work, writes as follows:

"At ordinary stages of water the river runs largely through the east channel of the draw, and with a little high water the current is very swift and the bottom scours to a great depth. Usually the water gets very low in the winter-time and the channel freezes over some times in December and remains closed until February. Under these conditions the bottom fills in, and the water in the east channel during the closed period is commonly from 25 to 30 ft. deep. It was our expectation to take advantage of the closed season in the winter-time, when the water is usually low, to put in falsework in line with the railway, removing the old draw span and erecting the new one in the usual way, but for some reason last winter the river got into bad habits and did not freeze up at the bridge site at all.

"Floating ice was running through the east channel the entire winter, and as the water kept unusually high, with a corresponding lowering of the bottom, it was impossible at any time to hold falsework in the east channel. During the period of high water while we were working on the bridge the water was as much as 60 ft. deep in the east channel. We waited as long as we dared for the river to freeze over in line with its usual habit, and as it did not freeze or the water get low enough to permit falsework, we were compelled to devise some means of erecting the draw at least over the east channel without falsework, as the new draw had to be in place before the opening of navigation in the spring.

New Span in Temporary Position between Old Trusses.

Cantilever Erection of New Trusses between Old Trusses.

"We found it possible to put falsework under the west arm of the draw, which was done, and upon investigation found that we could cut the old draw span in two over the center pier and remove the old west arm and enough of the old drum to permit the erection of the new drum and the new west arm, leaving the old east arm to carry traffic as a simple span. After this was accomplished it would permit us to erect the new east arm by cantilevering it out from the new west arm previously erected. We did not care to put any additional load on the old east arm, and, therefore, arranged to erect the new east arm so that it would carry the traveler and at all times be self-sustained without contact with the old east arm; that is to say, the old east arm merely carried its own weight and traffic during erection, and the new east arm carried itself and the traveler.

"In order to carry out the above plan the old east arm had to be lowered 3 ft. to permit the new bottom chords going over the old floorbeams. The track was, of course, retained at grade by blocking between the stringers and the floorbeams as the old arm was lowered. The old trusses were 20 ft. 1 in. apart on centers and the new trusses 17 ft. on centers. This did not allow enough clearance between the old trusses to permit the new ones being erected in their permanent position. Consequently, in order to get the new trusses inside of the old trusses, the new ones had to be erected in a temporary position about 15½ ft. apart on centers, or 18 in. closer together than in their permanent position. The new trusses of the east arm were built out from the new west arm with a traveler running on the new top chords. After

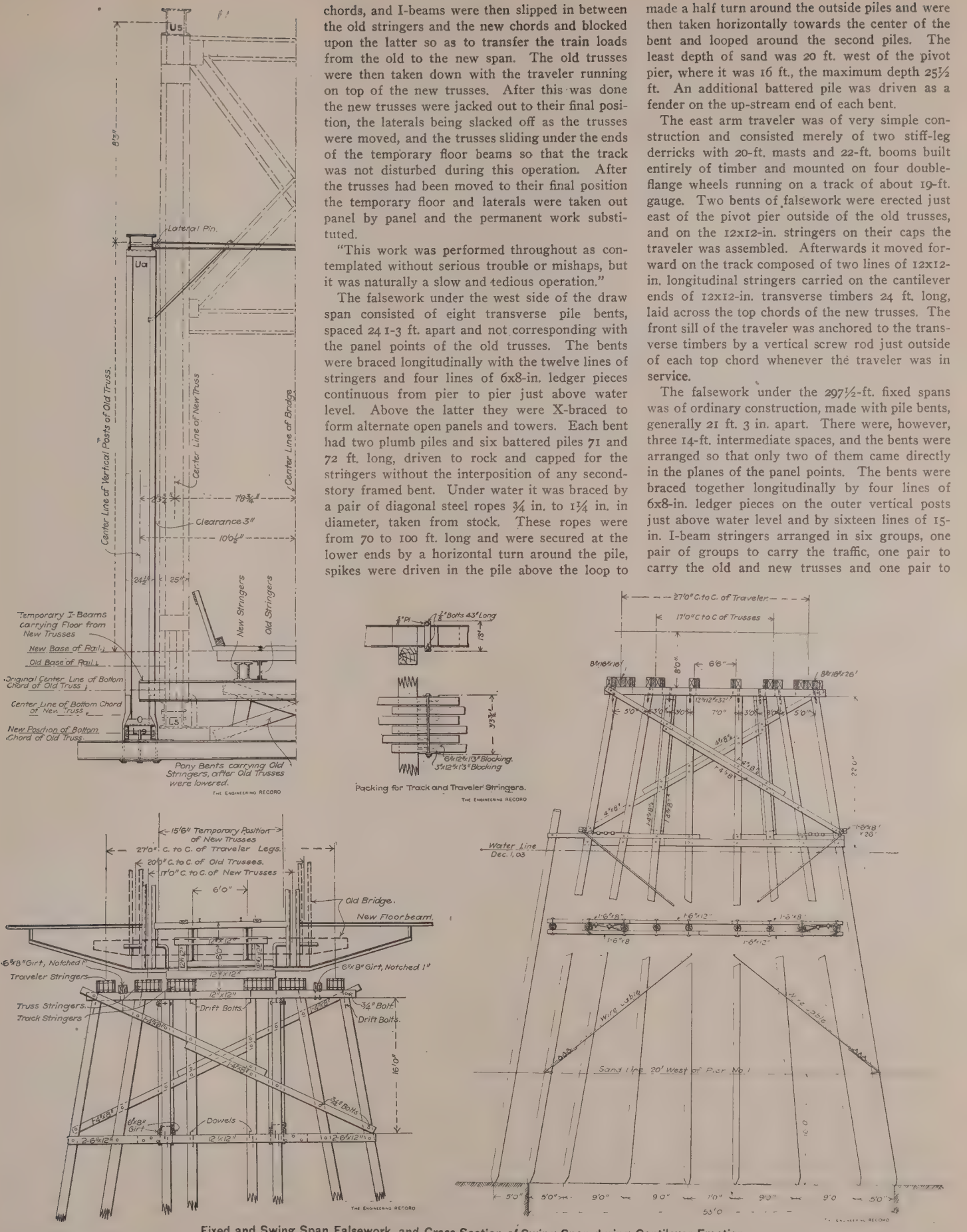
chords, and I-beams were then slipped in between the old stringers and the new chords and blocked upon the latter so as to transfer the train loads from the old to the new span. The old trusses were then taken down with the traveler running on top of the new trusses. After this was done the new trusses were jacked out to their final position, the laterals being slacked off as the trusses were moved, and the trusses sliding under the ends of the temporary floor beams so that the track was not disturbed during this operation. After the trusses had been moved to their final position the temporary floor and laterals were taken out panel by panel and the permanent work substituted.

"This work was performed throughout as contemplated without serious trouble or mishaps, but it was naturally a slow and tedious operation."

The falsework under the west side of the draw span consisted of eight transverse pile bents, spaced 24 1-3 ft. apart and not corresponding with the panel points of the old trusses. The bents were braced longitudinally with the twelve lines of stringers and four lines of 6x8-in. ledger pieces continuous from pier to pier just above water level. Above the latter they were X-braced to form alternate open panels and towers. Each bent had two plumb piles and six battered piles 71 and 72 ft. long, driven to rock and capped for the stringers without the interposition of any second-story framed bent. Under water it was braced by a pair of diagonal steel ropes ¾ in. to 1¼ in. in diameter, taken from stock. These ropes were from 70 to 100 ft. long and were secured at the lower ends by a horizontal turn around the pile, spikes were driven in the pile above the loop to made a half turn around the outside piles and were then taken horizontally towards the center of the bent and looped around the second piles. The least depth of sand was 20 ft. west of the pivot pier, where it was 16 ft., the maximum depth 25½ ft. An additional battered pile was driven as a fender on the up-stream end of each bent.

The east arm traveler was of very simple construction and consisted merely of two stiff-leg derricks with 20-ft. masts and 22-ft. booms built entirely of timber and mounted on four double-flange wheels running on a track of about 19-ft. gauge. Two bents of falsework were erected just east of the pivot pier outside of the old trusses, and on the 12x12-in. stringers on their caps the traveler was assembled. Afterwards it moved forward on the track composed of two lines of 12x12-in. longitudinal stringers carried on the cantilever ends of 12x12-in. transverse timbers 24 ft. long, laid across the top chords of the new trusses. The front sill of the traveler was anchored to the transverse timbers by a vertical screw rod just outside of each top chord whenever the traveler was in service.

The falsework under the 297½-ft. fixed spans was of ordinary construction, made with pile bents, generally 21 ft. 3 in. apart. There were, however, three 14-ft. intermediate spaces, and the bents were arranged so that only two of them came directly in the planes of the panel points. The bents were braced together longitudinally by four lines of 6x8-in. ledger pieces on the outer vertical posts just above water level and by sixteen lines of 15-in. I-beam stringers arranged in six groups, one pair of groups to carry the traffic, one pair to carry the old and new trusses and one pair to


Center Line of Vertical Posts of Old Truss.
Center Line of New Truss
Center Line of Bridge
Lateral Pin.
Clearance 3"
Temporary I-Beams carrying Floor from New Trusses
New Base of Rail
Old Base of Rail
Original Center Line of Bottom Chord of Old Truss
Center Line of Bottom Chord of New Truss
New Position of Bottom Chord of Old Truss
New Stringers
Old Stringers
Pony Bents carrying Old Stringers, after Old Trusses were lowered.
THE ENGINEERING RECORD
Packing for Track and Traveler Stringers.
THE ENGINEERING RECORD
15'6" Temporary Position of New Trusses
27'0" C. to C. of Traveler Legs.
20'0" C. to C. of Old Trusses.
17'0" C. to C. of New Trusses
6'0"
Old Bridge.
New Floorbeam.
6"x8" Girt, Notched 1"
Traveler Stringers
Truss Stringers.
Track Stringers
Drift Bolts.
¾" Bolts
Dowels
THE ENGINEERING RECORD
27'0" C. to C. of Traveler.
17'0" C. to C. of Trusses
Water Line Dec. 1, 03
Wire Cable
Sand Line 20' West of Pier No. 1
55'0

Fixed and Swing Span Falsework, and Cross-Section of Swing Span during Cantilever Erection.

the trusses were connected they were jacked up sufficiently at the east end to relieve the stress over the center pier. Temporary portal and lateral bracing was put in between both top and bottom prevent it from working up, and then the free end of the rope was brought back parallel with the standing part and secured to it in the usual way with three clamps. At the upper ends the ropes carry the traveler. The piles were X-braced longitudinally above water level so as to make alternate towers and open panels. The I-beam stringers overlapped the pile caps, and at their bearings

on them were clamped together with wooden fillers between their webs, and with yokes, consisting of horizontal top and bottom bolts, engaging vertical steel side plates. The track stringers supported short pony bents, on which the old track was wedged up while the new floor system was assembled and the old floor removed. There were no framed bents in the falsework for either fixed or swing spans except at the pivot pier, where, as before described, a short tower was built for the erection of the east arm traveler. In all cases the caps were secured to the tops of the piles by 1-in. drift bolts 22 in. long. All horizontal and diagonal braces were secured to the piles with single ¾-in. bolts at each intersection.

The Electric Pumping Station of the Schenectady Water Works.

The new electric pumping plant of the Schenectady Water Works is located at Rotterdam, about three miles west of Schenectady, adjacent to an old plant, with two vertical steam pumps of 6,000,000 gal. daily capacity each. The new station is rated at 24,000,000 gal. against a head of 110 lb., twice the output of the old steam plant, and occupies a very much smaller ground space.

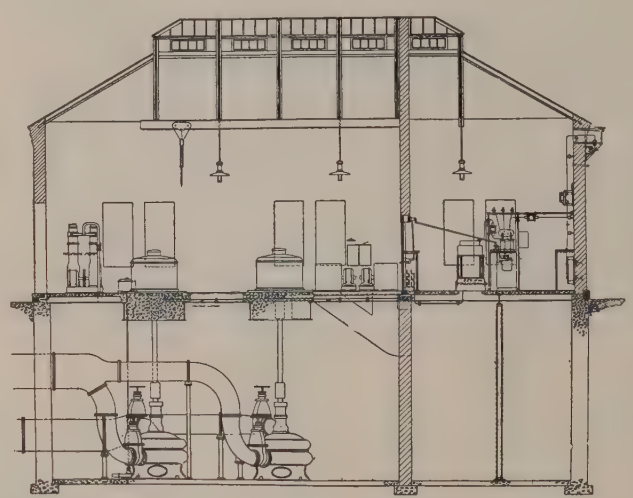
The pumps are 18-in. two-stage vertical shaft turbine type, built by Henry R. Worthington. Each consists of an outer casing, inside which is a set of fixed diffusion rings and vanes, and an impeller. The water enters the top of the casing at the center of the impeller, and is thrown out through the diffusion vanes into the discharge chamber. The vanes are so curved as to transform the kinetic energy, imparted to the water by the pump, into static pressure with minimum loss. The pumps are installed in the 21-ft. pit of the station, and draw the water through a 42-in. suction pipe from two circular wells 42 and 35 ft. deep and 50 ft. in diameter. These wells are near the electric pumping station building and are covered by a reinforced concrete structure. They have 3-ft. concrete walls, and gravel bottoms up through which the water filters.

The vertical shafts of the two main pumps extend to the station floor and are direct coupled to the rotors of two 800-h.p., 550-volt, 40-cycle, three-phase General Electric squirrel cage induction motors, installed on the station floor. The rated speed of the motors is 800 r.p.m., and their lubrication, a very important matter at such high speed, is effected by forcing oil at a pressure of about 100 lb. under the thrust bearing, which is arranged in the horizontal bearing shield on top of the motor. For supplying the oil, two vertical triplex Knowles oil pumps, each direct driven by a geared 3-h.p. induction motor, are provided. Since the main pumps are located above the normal water level of the wells, a two-cylinder, 9 x 7-in. vacuum pump, direct driven by a 5-h.p. induction motor, is installed on the station floor and used to produce a vacuum in the suction pipe so as to draw the water to the pumps when starting up. A drainage pump of the Worthington one-stage vertical volute type is installed in the pit. Its vertical shaft extends like that of the main pumps to the station floor, and it is driven at 1,200 r.p.m. by a direct-connected, 5-h.p., three-phase induction motor installed near the priming pump. All of the motors are supplied with 550-volt, 40-cycle, three-phase current, and have squirrel cage rotors.

Two separate and independent 10,000-volt transmission lines are provided, running from a sub-station of the Schenectady Illuminating Co., which furnishes the city of Schenectady with power and receives its current from the water power station in Mechanicsville and Spiers Falls. The lines are also connected to the power stations of the General Electric Works, as a further source of power. The lines are controlled at both ends by General Electric automatic oil switches, and protected at both ends by General Electric lightning arresters. The oil switches are so adjusted that a heavy overload of the pump motors will trip the switches at the pumping station end of the line only, so that the pump service can be resumed immediately by closing these switches. On the other hand, a dangerous overload, or a short circuit on the line, will trip the generating station switches also, thus protecting line and apparatus against injury.

At the pumping station the high tension current is stepped down to 550 volts by two banks of three 250-kw. single-phase air blast transformers. The transformer secondaries are provided with taps, wired to double-throw switches, for starting the 800-h.p. main pump motors at quarter and half voltage in order to avoid the heavy rush of current that would be caused if the motors were started at full voltage. There is also installed a 150-kw. lighting transformer which supplies current to the village and the railway station nearby. The necessary air blast is supplied by two independent induction motor-driven blowers installed on the station floor.

A fireproof partition separates the roomy compartment containing the bus-bars and all of the high tension apparatus—lightning arresters, disconnecting switches, oil switches, transformers, etc.—from the motor room, and the entrance from one to the other is closed by fireproof doors. Imbedded in and forming part of the partition is the switchboard, containing two incoming line panels, two high tension transformer panels, and two low tension main motor panels, equipped with the necessary ammeters, voltmeters, low tension lever switches for controlling the main pump motors, and handles for the remote control of the high tension oil switches which are installed in fireproof brick cells. On these panels are also installed the lever switches controlling the auxiliary motors and the vacuum and water-pressure gauges.



Section of Electric Pumping Station of Schenectady Water-Works.

The electrical layout is designed to co-operate with the use of the two independent supply lines in preventing any possibility of a total shutdown of the entire plant, upon the continuous operation of which depends the water supply of the city of Schenectady. Two sets of low tension busses are provided, and the double-throw switches enable either of the two banks of transformers to be switched on to either one of the two sets of bus-bars. The main and auxiliary switches are also double-throw, to facilitate switching over from one bus to the other.

The Use of Hydrated Lime.

Few materials are more extensively used than lime, yet until a few years ago the commercial form of the material had remained practically the same. Lump lime is now giving place, however, for many uses to hydrated lime, which is also finding a new field of application peculiar to itself. The material is still so new to many engineers and architects that attention is drawn to a discussion of its properties in a paper read before the National Lime Manufacturers' Association by Dr. E. W. Lazell, vice-president of the Henry S. Spackman Engineering Co., of Philadelphia. His explanation of the properties of hydrated lime is as follows:

Chemically speaking, it is lime plus water; that is, calcium oxide (CaO) plus water (H_2O). Fifty-six parts of calcium (CaO) unite with eighteen parts of water (H_2O), giving seventy-four parts of calcium hydrate $Ca(OH_2)$, or dry hydrated lime. These figures naturally apply only to the chemically pure material, and they show that one part of lime takes up about one-third of its weight in water, in the process of dry slacking. During this chemical combination heat is developed, and hence in hydrating the lime the same must either be confined so that the steam generated will not escape or an excess of water must be added. (An explanation of the process of manufacture was printed in this journal on April 29, 1905.)

A distinction must be carefully drawn between the half limes, or those which have been allowed to slack under the influence of the atmosphere, and the manufactured hydrated lime. The advantages of hydrated lime can be summed up as follows: Since it exists as a delicate white powder and comes into commerce in sacks, it is more easy to handle and can be more accurately handled and measured than the lump product. The method of handling this material resembles that of cement, and it requires no ageing after being mixed with water. Further, it does not deteriorate rapidly and can be stored for a long time in any dry place without undergoing material changes, thus doing away with the loss of lime due to spoiling and the danger of fire from the quick lime coming in contact with water.

The condition in which this lime is allows the impurities to be easily recognized and tests to be readily made. Hydrated lime can be as readily tested as cement, thus placing in the hands of the user the means of determining the character of the material.

To the manufacturer it offers the advantage of allowing him to use all of his burned product, the fine lime as well as the lump lime, and reduces his waste simply to pieces of underburned lime, too small to be reburned, and to the ashes of the fuel.

In the process of hydration care should be taken that sufficient time is given for the complete absorption of water, in order that all the lumps may be slacked, and thus do away with the danger of unslacked particles. To overcome this it is advisable to sieve the product either by means of bolting cloths or by air separation. The particles removed in this way consist of three kinds—unburned particles of limestone, unslacked particles of pure lime and particles which have not slacked owing to their high silica contents.

The uses of hydrated lime other than in mortar were next taken up by Dr. Lazell. Probably the first and greatest use of this material is in the sand-lime brick industry. Second he named its use as a hard wall plaster, either mixed with Portland cement or gypsum products. A third use is as an addition to Portland cement mortars, a fourth in the manufacture of slag cement, and a fifth in rendering more dense and waterproof concrete.

Sand-Lime Brick.—This industry, at first developed in Germany, was not long in being permanently established on this side of the water. Its foundation was due, according to Dr. Lazell, to the investigation of Dr. Michaelis, of Berlin, by which he hardened sand-lime brick with steam under pressure. The chemical reaction supposed to take place in this hardening is the combination of the hydrated lime directly with the sand to form an insoluble lime silicate, which furnishes the binding material for the brick. With the expiration of Dr. Michaelis's patent rights a few years ago it became possible to develop the industry on this side of the water, and at the present time we are seeing sand-lime brick factories spring up in all sections of the country.

With those of us who have come in contact with the sand-lime brick there can remain no doubt but that this material offers all the advantages possessed by the clay brick, together with a more sightly appearance and a greater architectural adaptation. In physical characteristics it resembles the very best grade of sandstone, and from the few tests already published it would appear to be superior in regard to strength and density to the red or building brick of the trade. Bricks are being successfully made both from the hydrated fat limes and the hydrated magnesia limes, but so far the better success appears to have attended the use of the fat limes. The best results are only obtained when the method of manufacture is such as to produce a maximum amount of the hydrosilicate, and this can only be accomplished in an atmosphere practically free from carbon dioxide (CO_2).

Hydrated Lime in Plaster.—It has recently been found out that a superior grade of wall plaster can be manufactured, using as a chief ingredient hydrated lime. The development of this industry, however, has been carefully concealed, and but little data can be given on the subject. It is perfectly feasible to make a dense and smooth wall plaster, whose base would be chiefly hydrated lime. Owing to the perfect hydration of the material and the ease with which it can be handled, it should be possible to give a more beautiful finish than any other class of material. Also, a proper study of the mixtures to be used should develop a plaster whose set can be accurately predicted and one which would work well, either in moist or dry weather. An advantage of such a plaster would be that it would not set as quickly as the high gypsum product, and further, it would work much more smoothly under the trowel, thus allowing a more uniform and dense surface to be obtained.

Hydrated Lime with Portland Cement Mortars.—It has been the custom in the past to add lime putty to mixtures of natural cement and sand in order to make the same work smooth under the trowel. The bricklayers object to the cement mortar because of the difficulty of handling it with the trowel. The use of a comparatively small proportion of hydrated lime with Portland cement mortars gives to it this characteristic of working smoothly under the towel, and bricklayers have found that this small addition increases the number of bricks that can be laid per man.

Slag Cement.—It has been long known that by mixing certain materials with slacked lime an hydraulic mixture is obtained which is nearly the equal of Portland cement. This fact was well known to the ancients, especially the Romans, who used for the mortar in the construction of their large buildings a mixture of slacked lime and volcanic ash. Many of these buildings are standing to this day, in a good state of preservation, and they are a monument to the stability of lime products. Following in the footsteps of the Romans, a slag cement industry has been developed in this country. This slag cement is nothing but a mixture of dry hydrated lime with granulated ground blast furnace slag.

Hydrated Lime and Concrete.—A practical method of rendering concrete impervious to water has long been sought for. No such practical method is at present known, Dr. Lazell says, and it is necessary to resort to the covering of concrete with water-proof materials, such as tars and asphalts. From experiments recently carried through it has been shown that by the judicious mixing of dry hydrated lime with the concrete aggregate a much denser and more water-proof material is formed. This is readily explained when we remember the large amount of water with which lime will combine to form a thick plastic mass. This paste will be formed in the outer layers of the concrete, and would retard and hinder the penetration of water into the mass.

Hydrated lime mixed with Portland cement is coming into extensive use for producing water-proof concrete work. In foundations, cellars and external walls the use of this form of lime is particularly desirable. The addition of 10 to 25 parts of hydrated lime to every 100 parts of Portland cement will produce a much denser artificial stone than Portland cement alone is capable of producing.

The German manufacturer of artificial stone prepares his hydrated lime a year in advance by the following method: Several large pits are dug, the lime is slacked and reduced to a fine paste and run into pits at their own works; the unslacked particles settle to the bottom, leaving a pure, clean paste above. When this paste is a year old it is considered to be fit for use in the manufacture of artificial stone. The cement and sand are first mixed, the hydrated lime paste added, and the three ingredients mixed in a concrete mixture directly before moulding into the forms. In this manner an artificial stone having superior water-proof qualities is produced.

Book Notes.

During recent years a number of investigations bearing on the quality of Iowa coals have been conducted under the direction of Profs. Bissell and Beyer. The results of these investigations, with various conclusions from their results, have been issued under the title, "Notes on Steam Generation with Iowa Coal," by the Engineering Experiment Station of the Iowa State College. The bulletin was written by Prof. Bissell and gives analyses of numerous coals and a discussion of the best methods of burning them.

A summary of the law relating to underground waters has been published as No. 122 of the Water Supply and Irrigation Papers of the U. S. Geological Society. It is entitled "Relation of the Law to Underground Waters," and was written by Mr. D. W. Johnson. In the first part of the pamphlet he gives a summary of the common-law rules concerning underground waters, and in the second part he outlines the legislative acts affecting such supplies. The main value of the book is probably its clear statement of the very divergent judicial opinions on the law of underground waters in different States.

The Osborn Engineering Co., of Cleveland, O., has brought out at $3 a new edition of "Osborn's Tables." This well-known manual was originally a collection of tables of moments of inertia and squares of radii of gyration of built members, supplementing the data in the books issued by rolling mills. In this edition, the moments and squares have all been refigured to agree with the standard sections now rolled and the best practice in combining them. To these tables have been added others of the working strengths of steel columns and the working strengths of timber beams and columns, a discussion of various standard loads and unit stresses and some valuable constants for determining the stresses in swing bridges. The book also contains other tables and memoranda of use to designers of structural steelwork.

In connection with the Geological and Natural History Survey of Connecticut, Dr. W. H. Conn, of Wesleyan University, is making a careful study of the protozoa, bacteria, algæ and allied plants of the State. He has prepared a preliminary report which describes, in detail, nearly 250 genera of protozoa, and these descriptions are accompanied by excellent illustrations and a key to assist the student in identifying the organisms. The classification is not carried beyond the genus and no descriptions of species are given. Although the subject is considered entirely from a biological standpoint and no attempt is made to connect any of the organisms with their habitat or their practical effect upon water supplies, nevertheless, it is one which will prove a valuable addition to the library of anyone who is interested in the subject of microscopic organisms.

Just at present the most discussed engineering monograph is unquestionably that "On Some Disregarded Points in the Stability of Masonry Dams," by Messrs. L. W. Atcherley and Karl Pearson, of University College, London. This monograph attacks the sufficiency of the hitherto accepted criteria of stability in such structures, based upon the general theory of elastic bodies, and supplements them with requirements based on a consideration of the shearing stresses that actually occur in such a structure. The results of this investigation are decidedly startling and have had a considerable influence on the present plans concerning the famous Assuan dam, as explained in The Engineering Record of April 22. The conclusions reached by the authors are that the vertical and not the horizontal sections of a dam are the critical sections, and that a dam built in accordance with the usual theories is most likely to fail by tension of the vertical sections near the tail. (London; Dulau & Co., 37 Soho Sq., 3s. 6d.)

The tenth annual report of the Boston Transit Commission contains very full data concerning the proceedings leading to the selection of the route for the new tunnel under Washington St., while the report of the chief engineer, Mr. Howard A. Carson, contains an excellent account of the completion of the East Boston tunnel. Particular attention is called, however, to the report of some important tests of large reinforced concrete beams. These were reinforced in various ways, and the experiments with them are among the most instructive yet made in this country. Mention is also made of tests to determine the effect of concrete in preserving metal imbedded in it. These tests were made with perfectly clean steel and with partly rusted metal, and showed that the concrete prevented oxidation. One interesting fact brought out was the change in porosity of a concrete cylinder which was kept filled with water. At first water percolated through the concrete readily, but at the end of two months it became practically water-tight.

THE GRAPHIC METHOD BY INFLUENCE LINES FOR BRIDGE AND ROOF COMPUTATIONS. By Wm. H. Burr and and Myron S. Falk. New York, John Wiley & Son; cloth, 8vo, 252 pp.; $3.00.

Engineers who are familiar with Professor Burr's "Stresses in Bridges and Roof Trusses" will enjoy reading this book, for it shows by comparison with that work the great changes that have taken place in methods of bridge and roof computation since the use of influence lines has become general. Probably their advantages were more generally recognized in Germany than elsewhere not very long ago, for graphical methods have always been very favorably regarded there. Nevertheless, at the present time, they are employed so extensively in American drafting offices that it is surprising no book was prepared before this which properly presented the subject.

In this work the authors first explain the general principles of graphic statics, the reader being assumed to have an acquaintance with elementary algebraic methods of computation, including that of moments or sections. The graphical analysis of roof trusses is described, and then the subject of influence lines for simply supported bridge trusses is discussed. This part of the book contains a clear explanation of the use of these lines and is the key to the following sections on the three-hinged arch, cantilevers and the deformation of trusses. The graphical method of finding deflections is not only interesting of itself, but it has such marked advantages in generality and rapidity that no structural engineer can afford to be without a knowledge of it. The volume closes with the detailed design of a 350-ft. single-track railway bridge, having a broken upper chord with subdivided panels.

Taken as a whole, the book is an excellent example of a clear and practical discussion of a subject which has been too often treated impractically. The advantages of graphical treatment are clearly pointed out and the book will unquestionably do much good in spreading a knowledge of them. It will be followed by a similar explanation of the application of influence lines to statically indeterminate structures, such as two-hinged and fixed-ended arches, swing bridges, suspension bridges and certain types of cantilevers.

Experimental Researches on the Constitution of Hydraulic Mortars. By Henri Le Chatelier. Translated by Joseph Lathrop Mack. New York, McGraw Publishing Co.; cloth. 12mo, 140 pp.; $2.00.

Unquestionably the most important monograph ever written on the technology of cements is the thesis submitted fifteen years ago for the degree of Doctor of Science by M. Le Chatelier. It has been the starting point for research work ever since, and it remains as valuable to-day, save in certain points of detail, as when it was first published. Although it is more frequently referred to than any other book on the subject, very few cement makers and chemists have ever had an opportunity to examine the whole of it, for copies have long been unobtainable. Mr. Mack has, accordingly, done a most valuable work in preparing this translation, proofs of which were read by M. Le Chatelier, who contributes footnotes explaining the most important advances in the subject since the monograph was written.

The chief object of this work was the study of the chemical reactions in limes and hydraulic cements during their calcination and hardening. When the researches were made very little careful work had been done in the chemistry of cements. Portland cement was manufactured under more or less control by chemists, but the process was essentially empirical. The difficulties of accurate investigations were great, the demand for cement was growing so fast that the chemists of the industry were fully occupied with routine work. M. Le Chatelier was, accordingly, compelled to begin his work with the most simple cementitious material, plaster, and then take up the silicates of barium, so as to secure a good point of attack on the true Portland cements. All this work is explained in detail in the book, and it is particularly interesting to observe the frequent reference to cement as a solid solution. The author's later work on other materials, in which the theory of such solutions has been very fully developed, has overshadowed the interesting references to the subject in this cement monograph. Probably no contribution in English to cement technology, with the possible exception of Mr. Richardson's monograph of last year, has approached in value this translation of M. Le Chatelier's thesis.

Letters to the Editor.

Factory Fire Risks.

Sir: The articles you have recently been publishing concerning the protection of factories against fire lead me to believe that your readers may be interested in an experience at the works of Veritys Limited in this city about a year ago. A fire commenced at one end of the top floor of a four-story building measuring about 200 x 50 ft., filled with valuable machinery and work in progress. The marvel is that, once well alight, it was possible to confine it to such a comparatively small area as was the case, about one-third of the roof being destroyed. This roof was of the saw-tooth type, slated on one slope and with iron sash and glass on the other slope, and this, in the owners' opinion, prevented the fire from running from one end of the shop to the other. It was evident that the flames ran up the rafters under the slates very quickly, but on arriving at the top of the ridge they were checked by the open space and had to curl down and commence again at a spot several feet below, and some distance away. This had to be repeated as each ridge was reached.

A second reason for the fire being confined was the use of armored fireproof doors over the openings into adjoining storerooms. These doors, built by Mather & Platt, stood the test remarkably well, and did not twist or curl under the action of the heat, as do ordinary iron doors.

Yours truly, C. Bennett Kingsbury.

Birmingham, Eng., May 11.

Combined Iron and Copper Sulphate.

Sir: In your report of the recent convention of the American Water Works Association, you refer briefly to the paper by Mr. Brown on the results obtained at Anderson, Ind., by using as a coagulant in the new filters at that place a mixture of a small amount of sulphate of copper with sulphate of iron. While the paper was in a sense a description of experiments conducted to prove the value of a product of the company with which the author is connected, although he omitted to mention this matter, nevertheless there were many of us who are responsible for the operation of mechanical filter plants who found his remarks decidedly valuable. In the Central States it is often possible to produce a satisfactory effluent with mechanical filters during most of the year, but at certain periods of short duration the bacterial count runs up or the water has a disagreeable odor or taste, even after it has passed through the filters. In our plant we have frequently retained chemists at such times, and have had much assistance from them, but if the results obtained at Anderson can be accepted as reliable and applicable in other places, they indicate that the new coagulant will solve most of our troubles in a better manner than they have been solved heretofore.

Managers of filter plants suffer needlessly from bacterial traditions. The French savant who said that water containing more than 100 bacteria per cubic centimeter was unsuited for domestic use has made us lots of unnecessary trouble. I make no pretense to bacterial or chemical knowledge, but unless all I have lately read on the subject is at fault, the actual number of bacteria in a water supply is of very little significance, while the character of the bacteria is highly important. Numerous specialists in water analysis have made this statement, and it relieves the apprehensions of water works superintendents very materially. Up to the time of the Anderson experiments we had not been told, however, of any coagulant that would act more strongly on the disease-producing germs than on the others which are of trifling interest. We have been forced to strain every resource to reduce the bacterial count in order that the total number of all species in the effluent should be a minimum, for only in this way could we keep the number of pathogenic species at the lowest possible figure.

The tests at Anderson seem to indicate that if a very little copper sulphate is used with iron sulphate as a coagulant, the reduction in the disease-producing germs is much higher than with only alum or iron sulphate. The percentage of reduction of total bacteria at that place by any of the coagulants was low, it is true, but if the results are judged by the removal of B. coli, which some authorities assert is the main criterion of successful water purification, then the new method is very satisfactory, for none of these germs were found in a filtrate produced with the copper-iron sulphates. With both alum and unmixed iron sulphate B. coli appeared in the effluents in every case, although the plant was operated by skilled attendants.

It is probably true that if my consumers knew of the use of copper sulphate as a coagulant in these works, I would be the most unpopular man in town, and consequently they will not be allowed to know about it. I have experienced one irruption of public sentiment in another city, when we began to use alum as a coagulant, and do not propose to have such an outburst bother us again. Nevertheless, in view of Mr. Brown's statement that the presence of copper in the effluents at Anderson could not be detected by the most delicate tests, I feel warranted in trying the new coagulant just as soon as the time comes around for our first period of bad river water. Our typhoid fever rate in this town has been pretty low, but every time our chemist reports that the raw water contains 25,000 bacteria per cubic centimeter, with plenty of B. coli among them, I feel so uneasy that the news of this combined copper-iron sulphate is most welcome. Manager.

[Mr. Brown's paper was decidedly interesting and encouraging, but in no wise conclusive. The American Steel & Wire Co., with which he is connected, is carrying on experiments under more favorable conditions than those at Anderson, and it is probable that before the close of the year more definite and complete data on the action of the new coagulant will be available. At present it seems best to suspend judgment on the subject, for it is too important to be decided one way or the other from any information now available.]

Dipping Steel in Paint.

Sir: I would like to know what the experience of the readers of the Record has been in the use of a tank for dipping structural steel, such as girders, columns, beams, etc., and if experience has proven the method of applying the paint to such work by dipping to be superior to that of painting with a brush, and whether such paint as red lead and oil could be successfully applied by a process of dipping.

Yours very truly,

Chas. A. Fingal.

Chicago, May 27.

[Some of the steelwork for the Williamsburg bridge at New York was cleaned by pickling and then protected by dipping in one of the preparations made by Edward Smith & Co.].

CURRENT NEWS SUPPLEMENT

JUNE 3, 1905.

DIRECTORY OF NATIONAL TECHNICAL SOCIETIES.

AMERICAN SOCIETY OF CIVIL ENGINEERS. Secretary, Chas. Warren Hunt, 220 West 57th St., New York. Annual convention, Cleveland, June 20-23. Next meeting, June 7, papers on reinforced concrete arches and on domes.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS. Secretary, F. R. Hutton, 12 West 31st St., New York. Annual meeting, Scranton, June 6-9.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS. Secretary, Ralph W. Pope, 95 Liberty St., New York. Annual convention, Asheville, N. C., June 19-23.

NATIONAL FIRE PROTECTION ASSOCIATION. Secretary, W. H. Merrill, Jr., Chicago.

AMERICAN INSTITUTE OF MINING ENGINEERS. Secretary, R. W. Raymond, 99 John St., New York.

AMERICAN INSTITUTE OF ARCHITECTS. Secretary, Glenn Brown, Washington, D. C.

ASSOCIATION OF ENGINEERING SOCIETIES. Secretary, Frederick Brooks, 31 Milk Street, Boston, Mass.

AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS. Secretary, W. M. Mackay, 235 Water St., New York. Annual meeting, Chicago, July 7 and 8.

CANADIAN SOCIETY OF CIVIL ENGINEERS. Secretary, Clement H. McLeod, 877 Dorchester St. Montreal.

SOCIETY FOR THE PROMOTION OF ENGINEERING EDUCATION. Secretary, Prof. M. S. Ketchum, University of Colorado, Boulder, Colo. Annual meeting, Atlantic City, N. J., June 28 and 29.

AMERICAN SOCIETY FOR TESTING MATERIALS. Secretary, Prof. Edgar Marburg, University of Pennsylvania, Philadelphia, Pa. Annual meeting, Atlantic City, June 29-July 1.

AMERICAN SOCIETY OF MUNICIPAL IMPROVEMENTS. Secretary, George W. Tillson, Room 12, Municipal Building, Brooklyn, N. Y. Annual meeting, Sept. 5-9, Montreal.

ASSOCIATION OF RAILWAY SUPERINTENDENTS OF BRIDGES AND BUILDINGS. Secretary, S. F. Paterson, Concord, N. H.

AMERICAN RAILWAY ENGINEERING AND MAINTENANCE OF WAY ASSOCIATION. Secretary, L. C. Fritch, 1562 Monadnock Block, Chicago.

AMERICAN WATER-WORKS ASSOCIATION. Secretary, J. M. Diven, Charleston, S. C.

AMERICAN FOUNDRYMEN'S ASSOCIATION. Secretary, Richard Moldenke, P. O. Box 432, New York.

ENGINE BUILDERS' ASSOCIATION OF THE UNITED STATES. Secretary, J. L. Lyle, 39 Cortlandt St., New York.

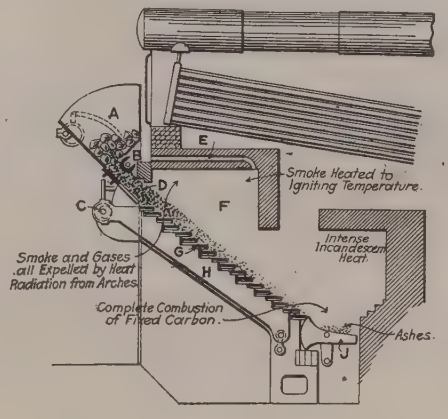
AMERICAN PUBLIC WORKS ASSOCIATION. Secretary, W. H. Flint, Chattanooga. Annual meeting, Chattanooga, Aug. 30-31.

A NEW AUTOMATIC STOKER.

A new automatic stoker and smoke consumer was recently exhibited by the Fulton Fuel Economizer Co. of Boston at the Homer St., Newton, power-station of the Newton & Boston Street Railway Co. The stoker has been in operation for about six months at this plant, and the first installation consists of a single equipment attached to a 125 hp. Babcock & Wilcox boiler.

The Fulton stoker, which combines smoke consuming and fuel economizing functions in its operation, is shown in the accompanying sectional drawing. Its designers aimed to produce a device to consume all the smoke and to maintain automatically a perfectly clean, even and steady fire over the entire grate surface, maintaining the highest possible rate of evaporation and utilizing any quality and commercial size of coal. In the drawing A is a cast iron coal hopper, B a corrugated cylinder running longitudinally across the boiler-front and serving as a crushing, agitating and feeding device; C, an eccentric shaft; D, an opening regulated by a sliding door, through which the coal passes; E, a row of a dozen parallel air inlets consisting of 1¼ inch iron tubes leading from the boiler-room to the furnace F, through firebrick walls; G, a set of alternately movable grates attached to the grate-bar H; and J, an ash pit damper. The crushing and stoking mechanism is driven by a small steam engine at the end of the boiler, which is spur geared to a shaft which drives the crusher with a rocking motion through an eccentric and pivoted shaft. A continuation of the arm operates the eccentric shaft C through a step by step motion, and this eccentric movement carries the grates through an elliptical cycle whose horizontal diameter is 1½ inches, giving a positive and continuous action of the grates, which feeds a uniform amount of coal to the furnace. The grates make three revolutions per minute, and at each revolution the coal is pushed off one grate upon the next lower one, alternate grates being fixed. The fire doors are left permanently open and the intensity of the fire is changed, if desired, by altering the speed of the engine. The perfect combustion enables the hand to be placed upon the under-side of the grate bar without discomfort. The fire burns without unevenness, breaks or holes, and no slicing, poking or disturbing in any way is required while the furnace is in service. The steady progress of the fire and the uniform action of the grates prevent clinker, caking or bunching of the fuel. The sliding door is adjusted by a set screw.

The combustion of smoke and gases in the furnace is produced by the arrangement of arches and check walls, which make their escape impossible until they are heated to or above their igniting temperature. In this condition the products of combustion are mixed with air supplied through the tubes shown, this point being near that portion of the fire where the fixed carbons are burning most intensely. An examination of the fire through a peep hole shows the bombardment of unconsumed particles against the bridge wall at the right of the furnace in the illustration; these particles become incandescent upon striking the wall and are consumed at once. No trace of smoke is visable to the eye as the flames finally pass upward through the horizontal aperture to the boiler tubes. The heated air for the combustion of the smoke is drawn in and controlled by the natural vacuum of the furnace, which automatically varies with the rate of combustion. The fundamental effort of the designers was to construct such a furnace that the small particles of coal cannot be drawn into the flues without coming in contact with sufficient heat to consume them, and that the carburetted hydrogen gas cannot leave until it has attained the high temperature required for its ignition and combustion.



THE FULTON STOKER.

In its performance at the Newton plant the stoker has required no repairs since its installation last fall, and in a test of 6 hours' duration recently made, it held the boiler pressure within the limits of 143 to 145 lbs. without attention during the entire run. In this test 3000 lb. of coal were burned in the furnace, and less than one-third as many lbs. of ashes were taken from the ash pit as were taken from the next boiler adjoining, which is fitted with plain grates and which burned about the same amount of coal. The boiler with the Fulton stoker is evaporating 10⅞ lb. of water per lb. of coal, against 7 lb. in the case of the plain grate. The smoke consumer feature is also now in use on about 600 steam locomotives, and under fair average conditions it is said to be saving about 1 ton of coal per 100 miles run. In stationary plants it is necessary to fire only about once in 30 minutes, and a reduction in attendance is thus made possible by the stoker.

The cardinal points of the Webster feed-water heater and chemical purifier are referred to in a pamphlet issued by Warren, Webster & Co., Camden, N. J. A discussion of the advantages of heating and purifying the feed water for boilers is presented, and supplemented by reference to the Webster chemical purifying system.

PROGRESS ON THE ROOSEVELT DAM.

A town of about 3,000 people is now established at Roosevelt, Ariz., on the Salt River, where the U. S. Reclamation Service is building a high concrete dam. The contract for it has been recently given to J. M. O'Rourke & Co., of Galveston, Tex., and the most serious work of the project will soon be under way. During the past year, however, a vast deal of important preliminary work has been accomplished by the inhabitants of Roosevelt. A temporary power plant, a cement mill, an ice plant, a lighting plant, and a saw mill have all been completed. The power canal, which will furnish water power for the generation of electricity to operate all the works, will be done in a few months. A telephone line connecting the headworks of the power canal, about 18 miles above Roosevelt, with the Arizona dam, which is about 30 miles from Phoenix, has also been installed. In the face of great engineering difficulties, a wagon road has been built between Phoenix and Roosevelt. A road to the timber in the Sierra Ancha Mountains has also opened up a new country. Altogether, it has been necessary to construct about 80 miles of road.

Much of this work has been done under most unfavorable circumstances. From February until the end of March there was almost continuous rain and snow. Never in the history of Arizona has snow been deeper than it was last winter, and the chances for high water during the entire summer are, unfortunately, almost certain. During the greater part of March the road to Globe was impassable and the Gila Valley, Globe & Northern Railway was out of commission. The Southern Pacific bridge across Gila at Maricopa was rebuilt half a dozen times during that month. It is apparent therefore that materials for construction work were not hauled into camp very rapidly during part of the past winter.

It might be said of the unwelcome rains, however, that they rather improved the power canal by consolidating the banks. The grading work for this canal was done by Sherer & Co., of Los Angeles, and the tunnel work by John Tuttle, of San Francisco. Water will be diverted from the river to the power canal about a quarter of a mile below the confluence of Pinal Creek and Salt River. The canal is 19 miles long and its construction has involve the excavation of about 600,000 cu. yd. of material and the driving of nearly 9,000 ft. of tunnel.

Until power can be obtained from the power canal, a temporary steam plant has been built for the purpose of furnishing power to the machine and wood shops and for running the cement mill. It has also run the hoist for the material, which has to be elevated 300 ft. to the cement mill, and has furnished light and power for drilling operations in the tunnels at the dam.

The cement mill, which has been ready to run since the middle of February, is now in operation. The fuel used in burning cement in the kilns is crude petroleum from the California oil fields. The beginning of manufacturing cement was delayed through the fact that only one tank of oil reached the mill during March. That had been two weeks on the road, weighed about 2,500 lb. and required 6 horses to haul it. The other oil tanks got stuck in the mud between Globe and Roosevelt and had to be abandoned.

About 400 tons of machinery and 60 tons of structural iron have gone into the construction of the cement plant. The ball mills weigh about 12 tons each; the tube mills when ready for grinding weigh about 20 tons, the crusher 15 tons, and the rotary kilns for burning the cement are 70 ft. long and weigh 40 tons each. Attached to the mill is a well-equipped laboratory under the charge of two chemists, who will devote all their time to standardizing the cement materials and testing the products of the mill. It is expected that about 200,000 barrels of cement will be required in the construction of the Roosevelt dam, the power canal, and the various Tonto improvements.

Two new gaging stations were established on Little Colorado River and its tributaries during March. A party has been surveying a possible power canal on Verde River, the power to be used to supplement that obtained from the dam when it is desirable to store water in the reservoir. It is proposed to do considerable reconnaissance work in the northern end of the Territory, at the headwaters of San Pedro River and on San Carlos and San Francisco Rivers.

Mr. Louis C. Hill is the supervising engineer in charge of the work on the Salt River project.

PROJECT FOR TUNNELING UNDER THE EAST RIVER, NEW YORK.

The method of tunneling that was employed in building the easterly half of the Harlem River tunnel of the New York Rapid Transit Subway forms the basis of a plan that has been submitted to the Rapid Transit Commission of New York City by Mr. D. D. McBean for the proposed roadway or combined street car and roadway tunnels under the North and East Rivers. The construction of the easterly half of the Harlem River tunnel was described in The Engineering Record, May 14, 1904, and the successful manner in which Mr. McBean carried it out indicates that the same method can be applied in building larger tunnels and in deeper water than was encountered in that work. Practically all of the operations on that work which offered obstructions to navigation and many of the accurate details requiring intricate work have been overcome in the present plans.

The outline of the plan is to build a tunnel having two 30-ft. roadways, with an arched roof of cross-braced built-up steel plate girders imbedded in concrete, with a continous cover of sheet-steel plates riveted to the girders, waterproofed and protected by concrete. The girders in the roof arch are supported at the middle on a longitudinal row of columns and at the ends on bearing plates in the monolithic concrete sidewalls. The floor is also of monolithic concrete, laid on a pile foundation in soft material.

The site of the tunnel is to be dredged to a few feet below the level of the springing line of the arch. piles driven in rows over the site, sawed off near the bottom of the excavation and capped. The roof of the tunnel is to be built in convenient lengths of 100 ft. or more, in floating open-topped boxes, or caissons, a temporary wooden floor laid on the bottom of the arch, and the ends of the section closed with sheet-steel diaphragms. As each section is completed the caisson will be scuttled and one end of it removed so it may be pulled from beneath the floating section of the tunnel arch. The section will then be floated over its site, weighted and lowered into place by tackles on scows in a manner similar to that followed in lowering and placing the sections of the Harlem River tunnel.

When each section is in position heavy sheeting, placed between guides attached temporarily to each section and lowered with it, will be driven longitudinally along both sides. The sheeting will be driven with followers and held in place by bolting a vertical steel plate, fixed longitudinally to the sheet-steel air-tight arch cover near the springing line on each side, through the sheeting to heavy outside longitudinal timber guide walings. The adjoining arch sections will be connected by bolting together outside flanges fixed to the continuous sheet-steel arch cover and the joint covered with concrete. The excavation outside the sheeting will then be back-filled to the top of the roof of the tunnel. When the sections have been connected the remaining material under the arch will be excavated to sub-grade by men working under air-pressure in the chamber formed by the arch and the sheeting driven at the sides, the concrete sidewalls and floor being built as this excavation progresses.

The feasibility of constructing a tunnel in this manner was demonstrated under adverse conditions in building the Harlem River tunnel. The depth of water over the site of the proposed East River tunnels is as great as 70 ft. in places, with the river bottom varying from soft mud to solid rock and the chief difficulty in employing the methods contemplated in the proposed plans in this depth of water will doubtless be encountered in driving piles to temporarily support the sections of the tunnel arch. Mr. McBean states, however, that he has successfully driven square timber piles with special guides and followers in as great depths as will be encountered on any of the proposed work.

The depths at which tunnels have to be driven to procure head room sufficient to insure safety from blow-outs in soft mud can be reduced by this method to the required harbor depth, as the extrados of the tunnel arch at the crown may be placed at any depth desired. The length of the tunnel approaches could be much reduced by thus raising the tunnel grades, and in the proposed plan the roadway portion of the tunnel is to be terminated at the bulkhead lines and the teams hoisted to the surface wth elevators. The car tracks may then be extended in a smaller tunnel under the streets to connect with the subways and open roadway approaches entirely avoided.

A LARGE SINGLE-PHASE LOCOMOTIVE FOR HEAVY RAILROAD SERVICE.

Of the many interesting exhibits of railway appliances prepared for the inspection of the delegates to the International Railway Congress, was the Westinghouse-Baldwin single-phase alternating-current locomotive shown in operation May 16 on the Interworks Railway at East Pittsburg. This locomotive was built by the Westinghouse Electric & Manufacturing Co. in order to convince the railway managers of the world of the possibilities and advantages of the use of single-phase current for the heavy electric traction and to demonstrate in the most convincing manner possible the ability of the company to supply the necessary apparatus. It was shown in operation first running light and then hauling a train of fifty new steel gondola cars weighing approximately 1200 tons.

THE NEW SINGLE-PHASE ELECTRIC FREIGHT LOCOMOTIVE OF THE WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY.

From the various details which are given below it will be seen that a number of new features are embodied in the construction of this locomotive and that claims of priority may be made for it in a number of respects. It is, for instance, the largest alternating-current locomotive in the world, the largest to be operated by singlephase current, and it is equipped with six of the largest singlephase motors ever built. It is the first alternating-current locomotive for use in America and is designed for the highest trolley voltage ever used in this country. This locomotive is also the largest ever operated by means of overhead trolleys, is the first on which forced ventilation is used in the motors, and is unique in many other ways.

The weight of the locomotive complete is 135 tons. It is built in two halves, each having one six-wheel truck with rigid wheel base. These are coupled together and are intended to operate normally as a single unit, but each half may be operated separately if desired. The locomotive is approximately 45 feet long over all, and 9 ft. 8 in. wide. The total height above the rail with trolleys lowered is 17 ft. The wheels are 60 in. in diameter and are mounted on 8-in. axles, 6 ft. 4 in. between centers. The side frames of the truck are of cast steel and are spring-supported in the usual manner, the weight on the two inside axles of each truck being equalized. The cabs are built of sheet steel with angle-iron supports and the entire cab as a whole is removable from the truck.

Each axle carries a 225-hp. single-phase series motor of the single reduction geared type, making a total of six motors for the locomotive. One side of each motor is supported directly on the axle and the other is suspended by spiral springs from the locomotive body. The motors are of the same general construction as the standard Westinghouse alternating-current railway motors of smaller size. They are so arranged that forced ventilation may be used and increased output thus secured.

The locomotive is designed for a current of 25 cycles and a trolley voltage of 6600, and one of the most striking points of the exhibition to those who have been accustomed to the enormous currents required in heavy direct-current traction work, was the sight of so large a locomotive accelerating a 1200-ton train over a third of a mile in length and receiving its entire power supply from a single No. 000 trolley wire.

The 6600 volt current is collected from the trolley wire by a pneumatically operated pantagraph trolley on each half of the locomotive and is carried through a suitable oil switch and circuit breaker to an auto-transformer in each cab. These transformers reduce the voltage to 325 for use at the motors. The trolleys may be raised or lowered from the cab by a suitable air valve.

The three motors on each half of the locomotive are connected permanently in parallel and are controlled by means of an inducton regulator, which, under the direction of the operator, varies the voltage at the motors from about 140 to 325. The induction regulators are driven by small series motors of the same general type as the main motors. Both regulators are controlled by the multiple-unit system from a master switch at either end. They may be stopped at any desired point in their travel and thus the locomotive may be run at any speed with the same facility and economy as a steam locomotive.

Forced ventilation is used with the auto-transformers and induction regulators as well as with the motors, the necessary air being supplied by suitable motor-driven blowers. Motor-driven air compressors are also used.

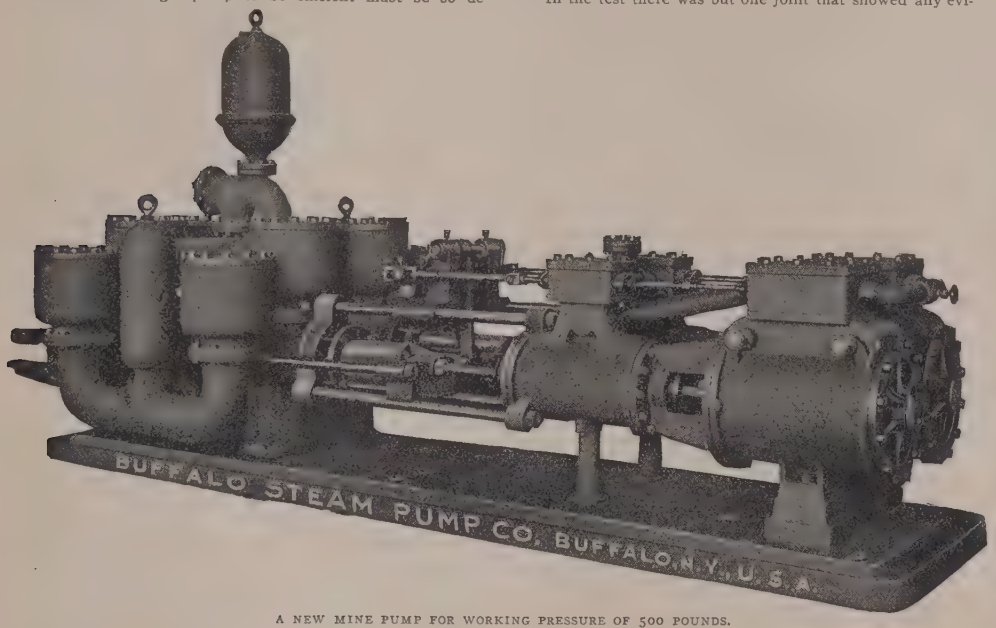
The locomotive is designed for slow-speed freight service, this type having been chosen because the design of series alternating current motors for very slow speed service presents many more problems and is much more difficult than the design of equal capacities for the ordinary conditions. This problem having been solved, the production of similar locomotives for passenger service becomes a relatively simple matter. With the motors working at nominal full load output the locomotive will develop a draw-bar pull of 50,000 lb. at a speed of approximately 10 miles per hour. On several occasions, however, when hauling the 50-car train referred to above, steady draw-bar pulls of from 60,000 to 65,000 lb. have been recorded on the dynamometer car, and momentary efforts as high as 100,000 lb. have been obtained with no sign of slipping of the wheels. With lighter loads the locomotive may be run at higher speeds up to a maximum of about 30 miles per hour.

The successful completion of so large and powerful an alternating-current locomotive without the usual series of developments through gradual increasing sizes, which is ordinarily required when so great a problem is undertaken, marks a distinct advance in the production of electrical apparatus for heavy traction work.

TWO NEW PUMPS.

The electrically driven, four-stage turbine pump shown in an accompanying cut was recently built for the Star Mining Co., in California, by the Buffalo Forge Co., Buffalo, N. Y. In a test at the makers' works it delivered 300 gal. of water per minute against a head of 800 ft. when running at 800 r.p.m.; the efficiency is not stated by the builders, but is understood to have been satisfactory. The pump is driven through a flexible coupling by a 100-h.-p. General Electric induction motor, the unit being substantially mounted on a single bedplate. In the design of the parts special attention was given the shape of the vanes and impellers in order to secure high efficiency. By using several stages, high peripheral speeds become unnecessary, and the lift attainable by a single runner is multiplied by the number of stages without increasing the number of revolutions beyond the limit at which direct connection with a steam engine or motor becomes impracticable. The makers make the following comments on the pump:

"The centrifugal pump to be efficient must be so designed that it will pick up the water from rest or from a velocity of perhaps 10 ft. per second, bring it to the high velocity required by the head pumped against, and then allow it to come to rest again in such a manner that during the whole operation there shall be as little internal friction, disturbance or loss by leakage and slippage as possible. The centrifugal pump derives much of its superiority from the fact that it can be driven by a high-speed engine or motor, profiting by the high efficiency of the latter when running under its most favorable circumstances, as well as developing a maximum of horse-power in a minimum of space."



A NEW MINE PUMP FOR WORKING PRESSURE OF 500 POUNDS.

Another new pump, built in the same city by the Buffalo Steam Pump Co., has been specially designed for the severe conditions of mine work, where the water may contain substances in solution which will attack the metal or may carry mud and sand which will cut the valves and cylinders. In the pump illustrated, the governing feature of the design has been to facilitate maintenance and other working qualities, and special attention was paid to providing easy means for making the adjustments inevitable in such service. The pump is provided with four single-acting outside-packed water plungers which work in the ends of the water cylinders, the latter having a partition in the middle. Each pair of plungers is connected together by heavy steel side rods, which are carried through cast steel crossheads, each of which is in turn connected to the piston rod of the tandem steam cylinders. Both sets of valves are placed in large chambers so located as to be easily reached, and being above the level of the cylinders, insure that they will be always primed. The uninterrupted area of each set of valves is equal to 50 per cent. of the plunger. The valve stems are provided with means for taking up wear and allowing the valves to be set without uncovering the steam chest. Any part of the pump can be removed without disturbing the neighboring parts or dismantling the machine. They are built to stand a working pressure of 500 lb. to the square inch.

Motor generator sets in multitudinous forms are described in Bulletin 9136 of the General Electric Co. The types referred to include rotary transformers for use in railway, lighting and power service, exciters, frequency changers, boosters and balancers. The effect which the motor-generator has had upon central station practice is interestingly depicted.

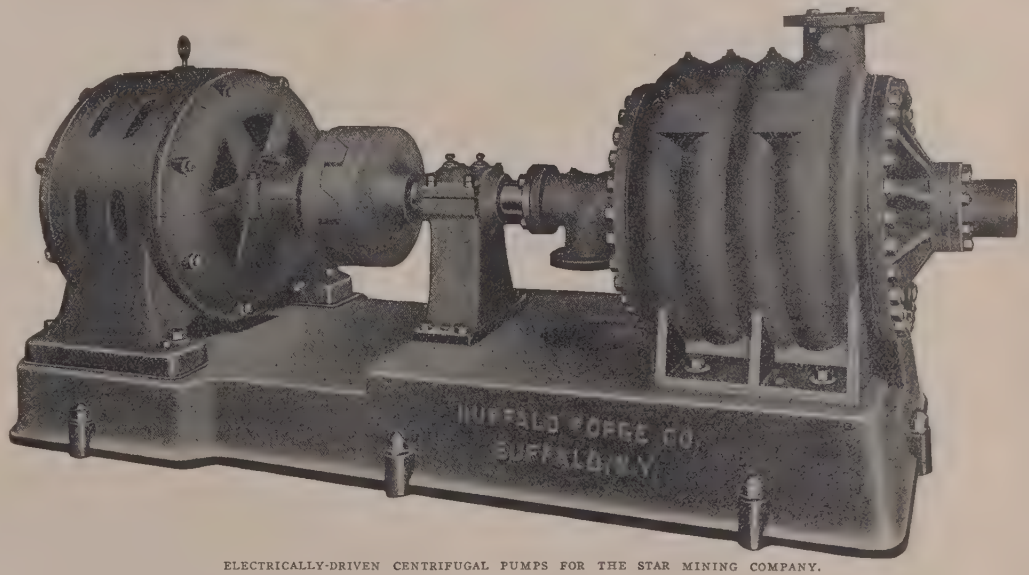
TEST OF LEADITE JOINTS.

Some time ago reference was made to a new compound called "leadite," which had been introduced at Philadelphia for making joints in cast-iron pipe lines. The chief ingredients are sulphur, brickdust and sand. The compound weighs 118 lb. per cubic foot, melts at 310° Fahr, and is a non-conductor of electricity. In making the joints an ordinary pipe jointer is used and the melted leadite is poured much like lead. No calking is required. A recent test was made in Philadelphia by Mr. John Montgomery, one of the water purveyors of that city, which he describes as follows:

"April 26, I made a test at the yard of the Bureau of Water, 26th and Master Sts., at which time there were ten 4-in. joints cast with leadite. There were about 2½ lb. of leadite used to each joint, including the pouring gate. All this was done by an inexperienced man, who had never made a joint of any kind before. The pipe and joints were subjected to a pressure of 100 lb. to the square inch.

"In the test there was but one joint that showed any evidence of leakage, which I think was caused by breaking off the gate before the material was thoroughly chilled. Each end of the pipe was plugged up with an iron bonnet—without any support whatever to prevent them blowing out. These joints all stood 100 lb. pressure test. With this pressure on a line of pipe 98 ft. long, all the blocking was removed except that under each end, allowing the pipe to settle about 2 ft., not causing leaks on any of the joints.

"On Saturday, April 29, there were uncovered on 28th St., below Clearfield, four 4-in. joints on a line of pipe 2,000 ft. long that was put in use in 1894, all the joints of same being made with leadite and in constant use ever since under a pressure of about 40 lb. Our examination showed them to be in good condition, with no evidence of decay or leakage."



ELECTRICALLY-DRIVEN CENTRIFUGAL PUMPS FOR THE STAR MINING COMPANY.

PERSONAL NOTES.

Mr. John W. Hackney has been re-elected city engineer of Atlantic City, N. J.

Mr. Henry M. Dickson has been appointed assistant city engineer of Fort Worth, Tex.

Mr. Clark G. Anderson, of Peoria, Ill., has been appointed city engineer of Moline, Ill.

Mr. Herbert C. Keith has removed his office to the Hanover Bank Building, New York City.

Mr. Joseph Ramsey, Jr., has resigned as president of the Wabash Ry. and will retire Oct. 1.

Mr. Harry N. Pharr has been re-elected chief engineer of the St. Francis, Ark., Levee Board.

Lieut. Commander Robert E. Peary expects to sail from New York about July 1 on the steamer Roosevelt on his next Arctice expedition.

Mr. W. L. Kinsell has been appointed mechanical engineer of the Northern Pacific Ry., with offices at St. Paul.

Mr. C. A. Barton has been appointed engineer in charge of levee and road construction in Shelby County, Tenn.

Mr. Daniel Breck, chief engineer of the St. Louis Merchant's Bridge Terminal Ry., has resigned to engage in private business.

Mr. A. L. Pond has resigned as superintendent of the municipal water works and electric light department, of Coldwater, Mich.

Mr. William Swift has resigned as engineer in the U. S. Reclamation Service to accept a position with the Isthmian Canal Commission as resident engineer.

Messrs. J. J. McVean and H. F. Northrup have opened an office in the Houseman Bldg., Detroit, Mich., for a general consulting civil engineering practice.

Mr. Edwin D. Vincent has been transferred from the Department of the Interior to the U. S. Reclamation Service, and will be engaged on work on the Colorado River.

Mr. Charles Varrelmann has resigned as street commissioner of St. Louis, Mo., and Mr. Frank W. Valliant, sewer commissioner of that city, has been appointed his successor.

Mr. John H. Lewis has been appointed state engineer of Oregon and will have charge of the state reclamation service, which is now co-operative with the U. S. Reclamation Service.

Mr. Wm. F. Morse has opened an office at 18 Broadway, New York City, for consulting sanitary engineering practice and as representative of a number of American and English refuse destructor manufacturers.

Mr. W. D. Lovell, of Minneapolis, Minn., has been delivering a series of lectures on water supply to the students in the engineering department of the University of Iowa.

Mr. E. L. Clarke has resigned as assistant engineer on the Delaware, Lackawanna & Western Ry., to become resident engineer on the Cleveland, Cincinnati & St. Louis Ry. at Mt. Carmel, Ill.

Mr. Willis F. Brown, general manager of the Windsor & Tecumseh Electric Ry. Co., of Ontario, Canada, has been appointed chief engineer in charge of construction in addition to his other duties.

Mr. D. D. McBean has been conferred with the degree of LL. D. by Queen's University, Kingston, Ont., in recognition of the unique methods he devised and employed in the construction of the Harlem River tunnel on the New York Rapid Transit Subway.

Prof. H. M. Howe, of Columbia University, has been elected foreign correspondent of the Society for the Encouragement of Industry of France, to succeed Sir Lowthian Bell. There are only four other holders of this honor at present.

Mr. O. M. Leland, of Cornell University, has left Ithaca for Skagway, Alaska, to resume work on the Alaskan Boundary Survey near the head of Lynn Canal. He will be accompanied by Messrs. S. L. Boothroyd, P. D. Coons, J. L. Jacobs and W. F. Smith as assistant surveyors.

Captain B. F. Reynolds, chief engineer of the Omaha water works, died at his home in Omaha, May 25. Capt. Reynolds was chief engineer of the Pioneer, which sailed from New York in 1866 in search of traces of the Sir John Franklin Arctic expedition and in 1881 was a member of the North Star expedition into the Arctic regions.

Sir Bernhard Samuelson, chairman of the Royal Commission on Technical Education, died in London on May 10. Mr. Samuelson was engaged in early railway shop construction in France, and later controlled agricultural implement factories and blast furnaces in England. He served a number of terms in Parliament and was knighted in 1884, for services to technical education.

A commission of engineers, consisting of Messrs. J. Waldo Smith, Nelson P. Lewis, I. M. de Varona, Allen Hazen and Prof. Wm. H. Burr, has been appointed by Mayor McClellan of New York City to examine the property of the local water companies in the Borough of Richmond and report on their value in event the city should decide to purchase them.

Mr. F. Neper has been appointed principal assistant engineer of the Missouri Pacific Ry., with headquarters at St. Louis and general supervision of surveys and new construction. Mr. J. O. Potts has been appointed assistant engineer of maintenance of way. Mr. A. W. Jones has been appointed assistant engineer in charge of construction at Keener, Ark.

Major Henry A. Gray, of the Canadian Public Works Department, died at his home in Toronto, May 23. He was born near Birmingham, England, and after passing the examination for the Royal Engineers in 1863 was sent to India and then to the West Indies. He went to Canada in 1866 and was actively engaged in railroad and government engineering work since then. He designed and erected a number of public buildings and was a prominent member of the Canadian Society of Civil Engineers.

The first meeting of the International Waterway Commission, which was appointed to investigate and report on the conditions and uses of the waters adjacent to the boundary line between the United States and Canada, held its first meeting in Washington, May 25. The American members of the Commission are Gen. O. H. Ernst, Corps of Engineers, U. S. A., Mr. George Clinton, of Buffalo, N. Y., and Prof. G. S. Williams, of Ann Arbor, Mich. The Canadian members are Messrs. W. S. King, J. P. Maybe and Louis Coste.

Mr. Julius Baier, who died recently in Ruby, Mont., received the degree of civil engineering from Washington University in 1885. He was afterward engaged on the reconstruction of the Eads bridge, the construction of the St. Louis Merchants' bridge, the St. Louis Coliseum and other prominent engineering works in the Middle West. He went to Colorado for his health in 1898, and after spending three years there became general manager of the Conroy Placer Mining Co., which position he held at the time of his death. In 1897 he received the Norman Medal of the American Society of Civil Engineers for a very valuable paper on wind pressures in the St. Louis tornado.

First Lieut. Elliott J. Dent, Corps of Engineers, U. S. A., has been ordered to report for duty under Lieut.-Col. Smith S. Leach, Corps of Engineers, U. S. A., in charge of the water supply system of Washington and the improvement of the Potomac River. Lieut. Dent will take direct charge of the operation of the Washington filtration plant on the relief of Capt. William P. Wooten, Corps of Engineers, U. S. A., who, as was recently noted in this column, has been ordered to take charge of the proposed improvement of the Trinity River, near Dallas, Tex. Capt. Wooten will probably remain in charge of the construction work on the filtration plant until it is practically finished, when Lieut. Dent will assume charge under the direction of Col. Leach.

Mr. L. B. Bidwell, principal assistant engineer of the New York, New Haven & Hartford Ry. has been retired from active duties on a pension. Mr. Bidwell entered railway service in 1853 as rodman on the Hartford, Providence & Fishkill Ry. and, with the exception of one year as transitman and engineer in charge of preliminary surveys and construction on the eastern division of the Union Pacific Ry., has been continuously in railroad engineering work in New England since then. He was chief engineer of the New York & New England Ry., and its successor the New England Ry., from 1879 to 1898, and from 1898 until he was appointed to the office from which he has just retired, he was assistant engineer in charge of the eastern district of the New York, New Haven & Hartford Ry.

Major E. T. D. Myers, president of the Richmond, Fredericksburg & Potomac Ry. and general superintendent of the Atlantic Coast Line Ry., died, May 12, at Richmond, Va. Major Myers entered railway service in the engineering department of the Richmond & Danville Ry. in 1848, and, with the exception of two years as assistant and principal assistant engineer of the Washington aqueduct, was continually engaged in railroad engineering work until he joined the Engineer Corps of the Confederate Army in 1861. He served throughout the Civil War with that corps and later entered the engineering department of the road of which he afterward became president. Major Myers was president of the American Railway Association for several terms, and was also a director of the American Society of Civil Engineers for one year.

Col. Wm. M. Patton, dean of the department of engineering of the Virginia Polytechnic Institute, Blacksburg, Va., died in New York City, May 26. Col. Patton was the author of a work on foundations and also a treatise on civil engineering, both of which have been widely used as reference and textbooks. He was at one time chief engineer of the Mobile & Ohio Ry., and had charge of the construction of the Susquehanna River bridge on the Baltimore & Ohio Ry. He was professor of engineering at the Virginia Military Institute for a number of years and afterwards became professor of civil engineering at the Virginia Polytechnic Institute.

Mr. George Gibbs has been appointed chief engineer of electric traction on the Pennsylvania, New York & Long Island and the Pennsylvania, New Jersey & New York R. R. companies. Mr. Gibbs will also be appointed chief engineer of electric traction on the Long Island Railroad.

An examination of candidates for the position of civil engineer and superintendent of construction in the Quartermaster's Department, U. S. A., will be held in various cities, June 28-29, by the United States Civil Service Commission. Considerable difficulty has been experienced in securing eligibles for this position and the Commission urges qualified persons to enter the examination.

Mr. Joseph Tomlinson, a pioneer designer and builder of steel bridges in this country, died at his home in Cedar Rapids, Iowa, May 10, Mr. Tomlinson was born in England, where he served an apprenticeship as a cabinetmaker, attending the Mechanical Institute at Newark at the same time. He became engaged on the Housatonic Ry. extension shortly after coming to this country, making reports on the designs of the wooden bridges that were being built at that time. He afterward built the Whitehall tunnel at the end of Lake Champlain and also built several bridges on the Whitehall & Rutland Ry. He was engaged in early construction work on the Illinois Central and rebuilt the 640-ft. span of the St. John's, New Brunswick, suspension bridge in 1857. The bridge across the Missouri River at Kansas City was designed by Mr. Tomlinson, and he also supervised its erection. He was in charge of the engineering department of the marine service of the Canadian Government for eight years, after which he became designer of bridges and buildings on the Canadian Pacific Ry. He went to England to superintend the fabrication of the Frazer River cantilever bridge and directed its erection.

Mr. E. M. Herr, general manager of The Westinghouse Air Brake Co., has been appointed first vice-president of the Westinghouse Electric & Mfg. Co. Mr. Herr is a graduate of Sheffield Scientific School and entered the motive power department of the Chicago, Milwaukee & St. Paul Ry. as special apprentice on leaving college. He afterward entered the motive power department of the Chicago, Burlington & Quincy Ry. as mechanical draftsman and engineer of tests and was later made superintendent of telegraph and then division superintendent of lines east of the Missouri River on that road. In 1889 he became master mechanic of the Chicaggo, Milwaukee & St. Paul Ry., resigning from that position in 1892 to accept the superintendency of the Grant Locomotive Works, in Chicago. He went to Russia to report on and establish a locomotive plant soon after this and shortly after his return was appointed general manager of the Gibbs Electric Co., of Milwaukee. He soon resigned his connection with the later company to become assistant superintendent of motive power on the Chicago & Northwestern Ry. and in 1897 went to St. Paul, Minn., as superintendent of motive power on the Northern Pacific Ry. He was elected assistant general manager of The Westinghouse Air Brake Co. in 1899, and was later made general manager of that company. The organization of the Westinghouse Electric & Mfg. Co. otherwise remains unchanged with the following officers: Messrs. George Westinghouse, president; E. M. Herr, first vice-president; Frank H. Taylor, second vice-president; L. A. Osborne, third vice-president; Newcomb Carlton, fourth vice-president; G. W. Hebard and W. M. McFarland, acting vice-presidents; C. A. Terry, secretary and counsel; T. W. Siemon, treasurer; James C. Bennett, auditor; B. G. Lamme, chief engineer; Chas. F. Scott, consulting engineer.

CONTRACTING NEWS

OF SPECIAL INTEREST TO CONTRACTORS, BUILDERS, ENGINEERS AND MANUFACTURERS OF ENGINEERING AND BUILDING SUPPLIES.

WATER.

Notes Arranged Alphabetically by States.

Ventura, Cal.—The Ventura Water, Light & Power Co. is stated to have decided to construct a new reservoir.

San Francisco, Cal.—The Bd. of Pub. Wks. is reported to have authorized the City Engr. to prepare plans for the West Richmond pumping station; probable cost, $53,125.

Sebastopol, Cal.—Wm. T. Searles, Town Clk., writes that about $50,000 will be expended on the water works and sewerage system. Engineer, N. S. Frost, of Petaluma.

Danbury, Conn.—The Council is reported to have instructed the Water Com. to proceed with the preparation of plans, etc., for the construction of the Boggs Pond reservoir.

Waco, Ga.—Bids will be received by Capt. B. B. Buck, Q. M., Ft. McPherson, until June 15, for furnishing materials and sinking a tubular deep well, laying 480 ft. 10-in. tile drain and doing 11,500 cu. yds. of grading at the U. S. Rifle Range, Waco.

Reynolds, Ga.—Ricks Bros. write that it is proposed to construct water works at a cost of $5,000, the water to be pumped from creek, 1 mile distant, to elevation of 125 ft.; 30,000 gal. per day.

Chicago, Ill.—Bids will be received until June 15 by the Dept. Pub. Wks. (Jos. M. Patterson, Comr.) for furnishing and delivering ten 36-in. gate valves.

Wynnewood, Ind. Ter.—See "Power Plants, Gas and Electricity."

Marlow, Ind. Ter.—The citizens are reported to have voted to issue bonds for a water supply.

Milford, Ia.—Leonard O. Pillsbury, City Clk., writes that about $8,000 will be expended for the proposed water works.

Chetopa, Kan.—See "Power Plants, Gas and Electricity."

Hammond, La.—The Town Council is stated to have contracted with C. H. Jencks, of Fayette, Miss., to supervise the construction of water works and drainage system for Hammond; probable cost of the work, $30,000.

Baton Rouge, La.—R. Smart, City Engr., will have charge of the construction of the proposed water works, street improvements, etc., for which the citizens voted May 16 to issue $300,000 bonds.

**Waterville, Me.*—The contract for laying c. i. water pipe and appurtenances in Waterville, Winslow, Fairfield and Benton (bids opened Apr. 29) has been awarded to the Boylston Constr. Co., of Boston, Mass., for $36,697. For list of bids received for this work see issue of The Engineering Record May 6.

Sharon, Mass.—Water bonds to the amount of $20,000 are reported sold.

Cambridge, Mass.—It is proposed to lay a 48-in. water main from Stony Brook reservoir to Fresh Pond, about 5 miles in length.

Trenton, Mich.—See "Power Plants, Gas and Electricity."

Saginaw, Mich.—Bids will be received until June 8 by the Bd. Pub. Wks. (Andrew J. Lynd, Clk.) for furnishing the following materials for the ensuing year C. i. water pipe and special castings, sewer castings and pipe, drain tile and natural and Portland cement.

Welcome, Minn.—The Village Recorder writes that it is proposed to construct water works, at a cost of $7,000.

Pine City, Minn.—Plans and estimates are reported as being made for water works and a sewerage system.

St. Cloud, Minn.—J. E. Hill, City Engr., is preparing plans and specifications for the construction of a sand filtration plant; probable cost $40,000.

Scanlon, Minn.—Bids will be received by the Village Council until June 6 for constructing a tower and tank. C. H. McNie, Village Recorder.

Boonville, Mo.—The citizens are reported to have voted to issue $75,000 bonds for water works.

Livingston, Mont.—The Livingston Water Co. is reported to be considering improvements, to cost in all about $100,000.

Campbell, Neb.—The citizens are reported to have voted to issue $7,000 bonds for water works.

Dodge, Neb.—See "Power Plants, Gas and Electricity."

Winside, Neb.—It is stated that bids will be received until July 1 constructing water works to cost about $12,000. A 60-ft. standpipe, elevated 100 ft. above the street will be erected. E. W. Cullen, Chmn., City Bd.

Newark, N. J.—Bids are wanted June 8 for c. i. pipe and special castings, as advertised in The Engineering Record.

Orange, N. J.—The Essex County Park Comn. has granted the Common Council permission to construct a reservoir in South Mountain reservation. Willett B. Gano, City Clk., writes that the probable cost of proposed reservoir, pipe line, etc., will be about $160,000. Fred T. Crane, City Engr.

Brooklyn, N. Y.—The following are the bids opened May 24 by John T. Oakley, Comr. Water Supply, Gas & Electricity, N. Y. City, for tapping 20 and 30-in. water mains in service and hauling and setting 6-in. hydrant service mains, fire hydrants and appurtenances on various streets in Brooklyn Boro.: J. W. Griffen, Arlington, N. J., $26, 225; I. Harris, Brooklyn, $42,587; Borough Constr. Co., Brooklyn, $46,567; P. Goodman, 1668 Park Ave., N. Y. City, $40,400, and M. J. Dady, Brooklyn, $43,465. The detail bid of J. W. Griffen, the lowest bidder, is as follows: 300 6-in. tapped connections with a 20-in. pipe, including excav. and fill, $40; 50 6-in. tapped connections with a 30-in. pipe, including excav. and fill, 75 cts.; 2,500 lin. ft. of 6-in. pipe to haul and lay, including excav. and fill, $1; 350 fire hydrants to haul and set and paint, including excav.

**Items marked thus give the names of parties awarded contracts.*

and fill, $5; 350 sq. yds. cobblestone pave relay 40 cts.; 500 sq. yds. of block pav. to relay, including sand foundation, 40 cts.; 250 sq. yds. block pav. to relay, including concrete foundation, $1.50; 1,059 sq. yds. asphalt pav. to lay, including concrete foundation, $3; 5,000 sq. ft. bluestone flag to relay, including sand foundation, 5 cts.; 600 sq. ft. cement concrete flag to lay, including cinder foundation, 10 cts.; 200 cu. yds. extra excavation, $1; 74,000 lbs. c.i. special castings for gate boxes, to furnish, deliver and set, 2½ cts.

Bids were opened same time and place for furnishing, delivering and laying water main and appurtenances in Hicks, Joralemon, Furman and Willoughby Sts. (bidders all of Brooklyn): John J. Cashman, $17,466; Borough Constr. Co., $18,870, and Isaac Harris, $20,837. The lowest bidder, John J. Cashman, bid for 250 tons straight c.-i. pipe, $30; 30 tons specials, $60; 1,200 lin. ft. 30-in. pipe, laid, etc., $1.66; 350 lin. ft. 20-in., $1.15; 100 lin. ft. 24-in., $1.50, and 100 lin. ft. 6in., 75 cts.

New Brighton, S. I., N. Y.—The Bd. of Estimate on May 26 voted to expend $1,500,000 in providing the Boro. of Richmond with water from New Jersey.

Lockport, N. Y.—The 30 days which the Common Council gave the Niagara, Lockport & Ontario Power Co. in which to accept the contract to supply Lockport with water expired May 24, and the contract goes by default. The city officials and the company failed to reach an agreement.

Medina, N. Y.—The citizens are reported to have voted to purchase the plant of the Water Wks. Co. for $70,000.

Troy, N. Y.—Saml. M. Gray, of Providence, R. I.; Rudolph Hering, of New York, and Dr. Wm. P. Mason, of Troy, are reported to have been selected as a commission to investigate the water of Tomhannock River, to be used as a water supply for city.

Chittenango, N. Y.—The Central New York Water Co. of Chittenango, is reported incorporated, with a capital of $100,000. Incorporators: W. Lee Cannon and Wm. B. Leigh, of New York; Geo. M. Bunting, of Chester, Pa.; H. B. Hodge, of Philadelphia, Pa., and others.

Oswego, N. Y.—Bids are wanted June 15 for laying the necessary pipe and special castings on land for the Lake Water extension, as advertised in The Engineering Record.

Ft. Wood, N. Y. H., N. Y.—Bids will be received by Capt. Traber Norman, Q. M., U. S. A., Governor's Island, for laying c. i. water mains and submarine main for water works at Ft. Wood, as advertised in The Engineering Record.

Cleveland, O.—Bids are wanted June 15 for the removal of 2 temporary cribs located in Lake Erie belonging to the Water Wks. Dept., as advertised in The Engineering Record.

Cheviot, O.—It is stated that bids will be received until June 7 by Chas. Craig, Village Clk., for furnishing labor and material for laying water pipe and setting fire hydrants in several streets.

Cincinnati, O.—Bids will be received until June 27 by the Bd. Trus. Comrs. of Water Wks. (Robt. V. Foster, Clk.) for laying c. i. pipe and special castings and valves on portions of Ludlow, Dodsworth and Hamilton Aves., and all miscellaneous work incidental thereto. The aggregate length of main to be laid is 4,470 lin. ft. of 20-in. c. i. pipe.

**Dayton, O.*—W. M. Koch, Asst. Clk. Bd. Pub. Service, writes that the contract for furnishing about 450 tons pipe and specials (bids opened May 10) has been awarded to U. S. Cast Iron Pipe & Fdy. Co.

**Elyria, O.*—The Snow Steam Pump Co., of Buffalo, N. Y., has secured the contract for a pumping engine, bids for which were opened Apr. 11.

Toledo, O.—Bids are wanted June 30 for the construction, delivery and erection of low-service pumping machinery for the improved water supply, as advertised in The Engineering Record.

Collinwood, O.—Bonds to the amount of $15,000 are reported sold, to be used for extending the water works.

Struthers, O.—It is reported that plans have been completed for the construction of water works, at a cost of $250,000. Seven reservoirs will be constructed along Yellow Creek, bet. Struthers and Poland. The expense of constructing the system will be paid for by the village and several large manufacturing plans located here.

Cleveland Heights, O.—Bids will be received until June 13 by the Village Council (Wm. G. Phare, Clk., 402 American Trust Bldg., Clevelanu) for $25,000 bonds, issued for the purpose of constructing water works for this village.

Crooksville, O.—C. N. Shryock, of Zanesville, Mgr. Muskingum Water Co., writes that it is proposed to construct water works at Crooksville, Roseville and other places; pumping station to be constructed at Taylorsville. A preliminary survey has been made by S. M. Taylor, of Pittsburg, Pa.; the pipe line will be about 10 miles in length; probable cost of work, $100,000.

McMinnville, Ore.—H. S. Maloney, City Recorder, writes that it is proposed to construct a gravity system of water works, to cost from $50,000 to $80,000. The city proposes to procure water from springs and is waiting for the dry season to measure the flow before final decision as to source of supply. Dr. Leroy Lewis, Chmn. Water Com.

Scottdale, Pa.—The Mountain Water Supply Co. is reported to have completed arrangements for the construction of a storage reservoir near Scottdale, to have a capacity of about 11,500,000 gal.

Bishopville, S. C.—Bids are wanted July 17 for the construction of water works, as advertised in The Engineering Record.

Kimball, S. D.—It is reported that bids will be received until June 15 by H. C. Smith, City Aud., for a compressed air system of water works. National Constr. Co., South Bend, Ind., are the engrs.

Jefferson, S. D.—The question of constructing water works is reported under consideration.

Yankton, S. D.—It is reported that plans are being prepared for the erection of a steel standpipe.

Rapid City, S. D.—The Council is reported to be considering the extension of water mains, 10,000 ft. on the north side.

Boliver, Tenn.—See "Power Plants, Gas and Electricity."

Chattanooga, Tenn.—It is stated that a stock company is about to be formed, to construct water works in Hill City, to cost about $20,000. T. W. Stanfield, W. P. Hays and W. S. Beck are reported interested.

**Clarksville, Tenn.*—The Herron Pump Co. is stated to have secured the contract for a 2,000,000 gal. pump for $7,650.

Sherman, Tex.—Bids are wanted June 26 for taking down a 20x130-ft. standpipe, etc., as advertised in The Engineering Record.

**Marshall, Tex.*—McQuatter Machinery & Plumbing Co. is stated to have secured the contract for water works improvements (bids opened May 20) for $30,000.

El Paso, Tex.—D. H. Whitmer, Ch. Engr. International Water Co., writes that all contracts have been let for the proposed improvements, which will cost about $500,000.

Richford, Vt.—F. H. Dewart, of St. Albans, is stated to have made for the Water Comrs. preliminary surveys on Loveland Brook for a storage reservoir.

Norfolk, Va.—See "Miscellaneous."

Calgary, Alta., Can.—It is stated that bids will be received until June 7 for laying 2 miles of 6-in. water main, 1½ miles of tile sewer, and 90,000 sq. ft. concrete sidewalks with curb and gutter. F. W. Thorold, City Engr.

Winnipeg, Man.—Bids are wanted July 3 for the construction of a covered concrete reservoir to hold 6,000,000 imperial gals., as advertised in The Engineering Record.

The date of opening of bids for the water pipe and specials only has been extended from June 5 to June 19, as advertised in The Engineering Record.

**Portage la Prairie, Man.*—Henault & Hefferan are stated to have secured the contract for constructing water works.

Oshawa, Ont.—It is stated that bids will be received until June 12 by the Water Comrs. (Thos. Morris, Secy.) for laying 12-in. c. i. submerged intake pipe, about 1,130 ft. long, for local water works. Willis Chipman, Engr., 103 Bay St., Toronto.

SEWERAGE AND SEWAGE DISPOSAL.

Notes Arranged Alphabetically by States.

**Birmingham, Ala.*—The Crockett Paving Co. is reported to have secured the contract for building the septic tank on the Valley Creek trunk sewer for $18,439.

San Francisco, Cal.—The Bd. of Pub. Wks. is stated to have authorized the City Engr. to prepare plans and specifications for a brick and concrete sewer on Fulton St., 27th Ave., C. St., and other streets; probable cost, $33,000.

Redding, Cal.—The citizens are reported to have voted May 22 to issue $130,000 bonds to extend the sewerage system and improve the streets.

Washington, D. C.—See "Power Plants, Gas and Electricity."

Moultrie, Ga.—The City Council is reported to be considering calling an election to vote on issuing $25,000 bonds for a sewerage system.

Quitman, Ga.—M. C. Wade, City Clk. and Treas., writes that it is proposed to construct a sewerage system, but cost has not yet been estimated. Engineer, H. S. Jandon, Quitman.

Bloomington, Ill.—Bids are wanted June 9 for pipe sewers on Gridley and Moulton Sts. E. Folsom, City Engr.

South Bend, Ind.—Specifications have been adopted by the Bd. of Pub. Wks for a mile of pipe sewers, 18 to 8-in., on 3 streets. A. J. Hammond, City Engr.

Indianapolis, Ind.—Bids will be received until June 12 by the Bd. Pub. Wks. (M. A. Downing, Pres.) for constructing 12 to 15-in. pipe sewers and appurtenances in portions of Ingram St. and an alley.

Greensburg, Ind.—It is stated that bids will be received until June 21 for about 20 miles of sanitary sewers, 8 to 24-in.; sewage disposal plant and 3 miles of storm sewers, 12 to 36-in. Wm. B. Ewing, Consulting Engr., 1003 Chamber of Commerce Bldg., Chicago, Ill.

Sioux City, Ia.—It is stated that bids are wanted until June 6 by the City Clk. for constructing an 8-in. sanitary sewer on W. First St. J. M. Lewis, City Engr.

Mayfield, Ky.—The citizens are reported to be discussing the question of issuing $100,000 bonds for street improvements and sewers. T. W. McNally, City Clk., writes with regard to same that it is not yet known what improvements will be made this year, if any.

Hopkinsville, Ky.—R. C. Hardwich, of Hopkinsville, on May 27, purchased a franchise for a sewerage system; work will begin in 60 days. About 10 miles of sewers will be constructed.

Louisville, Ky.—Press reports state that bids will be received until June 6 by Jas. B. Camp, City Treas., for $250,000 sewer improvement bonds.

Ft. Andrew, Mass.—The lowest bid opened May 29 by Maj. John E. Baxter, Q. M., U. S. A., Boston, for constructing a sewerage system at Ft. Andrew, Peddock's Island, Mass., was submitted by Cefalo & Ferguson, of Boston, for $2,267.

Worcester, Mass.—The House has passed the bill providing for an appropriation of $14,500 for sewage beds for the Worcester Insane Asylum.

**Lansing, Mich.*—H. A. Collar, City Engr., writes that the contract for constructing sewers in Water and other streets (bids opened May 15) has been awarded to M. E. Fitzpatrick for $22,900.

Gross Pointe, Mich.—Willis F. Brown, Law Bldg., Toledo, O., has been selected to prepare plans and estimates for Sewer Dist. No. 1; also to make surveys and plans with estimates for a boulevard for the village which adjoints Grosse Pointe Farms, the boulevard to be a continuation of the system now built at that place.

Houghton, Mich.—It is reported that surveys are being made for a sewerage system for West Houghton.

Saginaw, Mich.—See "Water."

Pine City, Minn.—See "Water."

New Ulm, Minn.—The Council is stated to have approved the plans of A. R. Starkey, of St. Paul, for the reconstruction of the sewerage system.

New Germany, Minn.—It is stated that bids are wanted until June 6 by the Common Council for constructing approximately 3,060 ft. 10-in. and 610 ft. 8-in. sewers with appurtenances. J. E. Egan, Engr., 10 Third St., S., Minneapolis.

North Platte, Neb.—Three bids, ranging from $35,500 to $42,000 were opened May 25 for the construction of main sewers; new bids will probably be received. Wm. Yost, City Clk.; Andrew Rosewater, Engr., Omaha.

Norfolk, Neb.—Andrew Rosewater, of Omaha, is stated to have been selected to prepare preliminary surveys and plans for a sewerage system for Norfolk.

**Asbury Park, N. J.*—Mart Rogers, City Engr., writes that the contract for constructing 3,500 ft. of 18-in. sewer (bids opened May 22) has been awarded to S. L. Bartholomew, of Asbury Park, for $9,930.

Long Island City, L. I., N. Y.—Bids will be received June 12 by Jos. Cassidy, Pres. Boro. Queens, for constructing sewers and appurtenances in portions of 10 streets. Engineer's estimate: 6,441 lin. ft. 12-in. vitr. salt-glazed or cement concrete sewer pipe 4,056 lin. ft. 6-in. vitr. salt-glazed or cement concrete sewer pipe as risers for house connections 48 manholes, complete 38 M. ft. B. M., timber for bracing and sheet piling, etc. also for furnishing and delivering where required in the Boro. Queens vitrified stoneware sewer pipe or cement concrete sewer pipe. Engineer's estimate: 4,000 lin. ft. 12, 15, 18 and 24in. pipe.

Long Island City, L. I., N. Y.—Bids will be received until June 12 by Jos. Cassidy, Pres. Boro. Queens, for constructing a sewer and appurtenances in a portion of 1st Ave. Engineer's estimate: 945 lin. ft. 12 and 15-in. vitr., salt-glazed or cement concrete sewer pipe; 60 lin. ft. 12-in. vitr., salt-glazed or cement concrete culvert pipe; 840 lin. ft. 6-in. vitr. salt-glazed or cement concrete sewer pipe, as risers for house connections; 7 manholes, complete, etc.

White Plains, N. Y.—The Governor has signed the bill creating a commission of one member each from Yonkers, Mt. Vernon and White Plains to provide for the construction of a $2,000,000 trunk sewer through the Bronx Valley, emptying into the Hudson, to prevent the pollution of the streams of Westchester County. The Bronx Valley sewer is to be 17 miles in length. It will drain the entire territory from White Plains to Mt. Vernon, including the 7th Ward of Yonkers, and passing under the city of Yonkers by means of a tunnel having its outlet in Hudson River at lower boundary line of Yonkers. John E. Andrus, Mayor of Yonkers; Wm. Archer, of Mt. Varnon, and John J. Brown, Pres. of White Plains, are the Comrs. The bill stipulates that the sewer must be completed in 3 years, otherwise its management will revert to the Bd. of Superv. of Westchester County.

**Lestershire, N. Y.*—F. D. Allen & Co., of Oneida, is stated to have secured the contract for the construction of sewers (bids opened May 12) for $31,390.

Ballston Spa, N. Y.—The following are the bids opened on May 25 by the Bd. of Trus. for constructing about 8 miles of sewers. (Engineer, John M. Farley, 5 Court St., White Plains; Irwin & Koester, Greenville, O., $24,451; Albany Material & Constr. Co., Albany, $29,378; J. H. Clement & Son, Schenectady, $29,776; DeNallo & Klingberg, Kingston, $32,593; Kellern & Shaeffer, Schenectady, $34,189; Chas. D. Beckwith, Schenectady, $36,334; Denniton & Co., Rochester, $37,823; T. J. Reynolds, Syracuse, $38,184; John E. Gaffney, Saratoga, $39,181; Martin Sweeney, Saratoga, $52,372, and Wm. Stanton & Co., Cohoes, $53,834.

Morgantown, N. C.—It is stated that bids will be received until July 1 for 23,000 ft. of 6 and 8-in. pipe sewers estimated to cost $12,000. W. E. Walton, Chmn. Sewer Com.

Middletown, O.—F. W. Sullivan, Asst. City Engr., writes that the Council has authorized the construction of 10,000 ft. of sewer, of which 4,500 ft. will be of concrete. Frank Doty, Engr.

Marion, O.—It is stated that bids will be received until June 7 by the Bd. Pub. Service (Wm. Fries, Clk.) for constructing 2 sanitary sewers and collar drains.

Ravenna, O.—Contracts will probably be let the latter part of June for the construction of about 17 miles of 8 to 15-in. sanitary sewers and a sewage disposal plant. Engineer, W. E. Meyers, of Kenton. S. J. Post, Village Clk.

Cleveland Heights, O.—Bids will be received by the Village Council (Wm. G. Phare, Clk., 402 Am. Trust Bldg., Cleveland) until June 27 for constructing sewers in a portion of Mayfield Road, of brick, concrete and vitr. pipe. The Wm. H. Evers Eng. Co., Engrs., 237 Arcade Bldg., Cleveland.

Bids will also be received same date and place as above for $38,115 sewer improvement bonds.

Cuyahoga Falls, O.—C. D. Crumb, City Clk., writes in regard to the construction of a sewerage system that the question was defeated in 1904, and will probably not come up again for a year or two.

Portland, Ore.—Local press reports state that City Engr. Wanzer has revised and improved the plans for the new Irvington sewer, and the contract for construction will soon be let.

Allentown, Pa.—Bids will be received until June 6 by Alfred J. Yost, Mayor, for furnishing material and constructing a concrete sewer in a portion of Sumner Ave.

Gallitzin, Pa.—Bonds to the amount of $20,000 are reported sold to be used for improving the sewerage system.

Bids will be received until June 7 by the Boro. Council (W. R. Conrad, Secy.) for constructing a concrete sewer. Henry & Dillman, Engrs., Rm. 49, Altoona Trust Bldg., Altoona.

Chattanooga, Tenn.—The citizens are reported to have voted May 23 to issue $150,000 bonds for sewer and street improvements, and $125,000 for schools and parks.

Galveston, Tex.—Bids are wanted June 22 for the extension of 33d St. sewer from its present dead end to Bway., also leads, manholes, catch basins and appurtenances, as advertised in The Engineering Record.

Ft. Worth, Tex.—John B. Hawley, City Engr., writes that it is proposed to construct a sewerage svstem in the 5th, 6th, 7th and 8th Wards, at a probable cost of $70,000. Bids will probably not be asked for 3 months.

Norfolk, Va.—See "Miscellanous."

**Puyallup, Wash.*—Jas. Lee, of Tacoma, is stated to have secured the contract for constructing sewers in Dist. A. (bids opened May 10) for $24,035.

Janesville, Wis.—It is reported that bids are wanted until June 22 for constructing sewers in Dist. No. 5; J. F. Hutchinson, Clk. Com.

**Items marked thus give names of parties awarded contract.*

Milwaukee, Wis.—It is reported that bids are wanted June 6 for constructing a sewer in West and South Sewerage Dists. P. Pawinski, Compt.

**Ashburnham, Ont.*—Jas. Bogue, of Peterborough, is stater to have secured the contract for building an outfall sewer and septic tank in Ashburnham, for $9,410.

Calgary, Alta., Can.—See "Water."

BRIDGES.

Notes Arranged Alphabetically by States.

**Oakland, Cal.*—The Dundon Bridge & Constr. Co., San Francisco, is stated to have received the contract for constructing a bridge over Arrow del Valle for $6,951.

Lawrenceville, Ga.—It is reported that bids will be received until July 6 by the Bd. Co. Comrs. of Guinnett Co., at Lawrenceville (O. O. Simpson, Chmn.) and the Ordinary of Milton Co., at Alpharetta, for constructing the following steel highway bridges over the Chattahooche River: Two 155-ft. spans with 16-ft. roadway and steel cylinder piers at Jones Ferry; a 190-ft. span with a 16-ft. roadway and cylinder piers at McClure's Ferry; also alternating proposition for a one 200-ft. span, same place; also 2 structures, each having a 220-ft. span and a 16-ft. roadway at Rogers' and Abbot's Ferries, cylinder piers being used.

Indianapolis, Ind.—Bids will be received by the Co. Comrs., at Indianapolis, until June 15 for constructing several culverts throughout the county.

Boston, Mass.—City Engineer Jackson is stated to have opened bids on May 25 for building abutment and retaining walls on the Boston approach to the Brookline St. bridge, as follows: Jas. J. Coughlin Constr. Co., $29,300; Metropolitan Constr. Co., $37,780; Cefalo & Ferguson, $36,974; Ruggles & Perkins, $33,695; Falvey & Kelly, $49,800; Nawn & Brock, $37,625; Patrick McGovern, $43,459; W. H. Ellis, $41,951; D. F. O'Connell Co., $35,000; T. Stewart & Sons Co., $37,950; Henry McGahey, $35,517; Shaler McCormick, $38,950; W. L. Miller, $32,973; H. Gore Co., $37,308.57; Jeremiah J. Sullivan, $36,411; Lawler Bros., $32,554, and Jos. Ross Cor., $47,073.

Ada, Mich.—Bids are wanted June 24 for furnishing material and constructing a steel bridge across Grand River in Sect. 7 of the Township of Ada, as advertised in the Engineering Record.

**Kansas City, Mo.*—The American Bridge Co., St. Louis, is stated to have received the contract for constructing a viaduct over the tracks of the Union Pacific and Missouri Pacific railways tracks at James, 12th and Genesee Sts., for $75,000.

O'Neill, Neb.—It is stated that bids will be received until June 20 by E. S. Gilmour, Co. Clk., for constructing a bridge across Niobrara River.

Brooklyn, N. Y.—The lowest bid opened on May 26 by the Brooklyn Grade Crossing Comn. for furnishing steel and other material to be used in the construction of 15 bridges, for carrying highways in South Brooklyn, over the proposed cut and depression of the tracks of the Manhattan division of the L. I. R. R., is stated to have been submitted by Milliken Bros., 11 Bway., N. Y. City, for about $550,000.

*The contract for the concrete abutments of the bridges above named is stated to have been awarded to See Bros. for $115,000, and the terms of that contract may also be extended to cover all bridges at same rate.

Savannah, N. Y.—It is stated that the Central R. R. will replace the stone piers of the Seneca River bridge with a concrete substructure at an estimated cost of $200,000.

Elmira, N. Y.—Bids will be received by the Lake St. Bridge Comn. on June 15 for the construction of the Lake St. bridge, as advertised in The Engineering Record.

Fargo, N. D.—Bids will be received until June 20 by the Bd. Co. Comrs., for constructing 2 bridges 130 ft. long; 1 in Harwood and the others in Pleasant Township, and one 24-ft. long in Casselton Township; also for reconstructing the approach to the bridge over the Red River in Fargo at Front St.; Arthur G. Lewis, Co. Aud.

Lakota, N. D.—Bids will be received June 10 by the Bd. Co. Comrs., for furnishing materials and constructing a bridge over the Sheyenne River; Henry Telande, Co. Aud.

Cincinnati, O.—The City Engineer is stated to have estimated the cost of repairing Liberty St. viaduct at $48,000.

Toledo, O.—The City Council is stated to have passed a resolution directing the Bd. of Pub. Service to prepare plans and specifications for a bridge to be either concrete or steel, the width of structure to be 82 ft. wide and cost about $800,000.

Zanesville, O.—Bids will be received until June 15 by the Bd. Co. Comrs., for furnishing material and rebuilding the protection cribs to the draw pier of the bridge over the Muskingum River, near the mouth of Burch Creek; L. M. Brelsford, Co. Aud.

Delaware, O.—Bids will be received until June 6 by the Bd. Pub. Service, for constructing a steel concrete bridge at Washington St., to consist of 7 spans, one 90, two 86, two 80, and two 74 ft. long. The roadway to be 36 ft. and walks each 9 ft. wide.

Vale, Ore.—It is stated that bids will be received until July 5 by the Co. Comrs. for constructing 2 wagon bridges, 1 over Owyhse River and the other over Malheur River. W. G. Thompson, Co. Clk.

Berwick, Pa.—It is reported that bids will be received until June 13 by the Bd. Pub. Grounds and Bldgs., Harrisburg (J. M. Shumaker, Supt.) for rebuilding the substructure and superstructure of bridge over the Susquehanna River, between Berwick and Nescopec.

Catasauqua, Pa.—L. S. Shimer, of Shimmerville, Chmn. Co. Comrs., writes that the following are the bids opened May 27 by the Comrs. of Lehigh County at Allentown, for the construction of a steel highway bridge across Lehigh River at Catasauqua: Berlin Constr. Co., $97,700; New Jersey Bridge Co., $91,000; Belmont Iron Co., $89,000; W. H. Gulick, Phoenixville, $111,257; York Bridge Co., $87,590; Alleger & Co., $89,000; Penn Bridge Co., $89,900; King Bridge Co., $92,300; Owego Bridge Co., $94,300; Canton Bridge Co., $91,000; Groton Bridge Co., $94,000; Nat. Construction Co., $107,000; Eyre Constr. Co., $89,950; Horn & Neff, $89,000, and Nelson & Buchanan, $92,900.

Tiverton, R. I.—Bids will be received June 28 by Lieut. Col. J. H. Willard, Corps Engrs. U. S. A., Newport, for enlarging draw opening in stone bridge over Sankonnet River, Tiverton, as advertised in The Engineering Record.

Tacoma, Wash.—It is stated that bids will be received until June 9 by the Co. Comrs. for constructing a trestle 265 ft. long across gulch on Gehring County Road. J. M. Howell, Co. Aud.

Charleston, W. Va.—Bids are wanted June 15 for the construction of a truss bridge across Elk River, connecting Charleston and Lovell Sts., as advertised in The Engineering Record.

Berlin, Ont.—It is stated that bids will be received until June 6 by Herbert J. Bowman, Berlin, for concrete work on boundary line between Waterloo and Wellington Counties; for concrete pier at Chamber's Bridge over Grant River, and for concrete arch, 20 ft. span, near Winfield.

PAVING AND ROADMAKING.

Notes Arranged Alphabetically by States.

Redding, Cal.—See "Sewerage and Sewage Disposal."

**Wilmington, Del.*—The Street and Sewer Com. is stated to have awarded on May 23 the contract for furnishing 2,500 sq. yds. granite block and paving a portion of Church St. with same to Stewart & Donohue for the material at $1.55 per sq. yd. to Davis & Bros. at 22 cts. per sq. yd. for the labor.

**Jacksonville, Fla.*—The contract for clearing the right of way and grading about 3 miles of the Orange Park Road is stated to have been awarded to Boykin, Burwell & Henderson at $25 per acre for clearing and grubbing the right of way and 15 cts. per cu. yd. for grading.

Indianapolis, Ind.—It is stated that Northwestern Ave. will be paved with Warren Bros. bitulithic pavement.

Hartford City, Ind.—Wm. Harley, City Engr., writes that it is proposed to expend about $125,000 in paving with brick or block. Bids will be received for this work on June 8 and on other dates not yet set.

South Bend, Ind.—It is proposed to macadamize Foote St., about 2,400 sq. yds. A. J. Hammond, City Engr.

Greensburg, Ind.—It is stated that the Comrs. of Decatur County will soon receive bids for constructing 31 miles of gravel road in Adams and Clinton Townships.

Washington, Ind.—The Comrs. of Daviess County will soon receive bids, according to reports, for constructing 25 miles of gravel walks.

Crawfordsville, Ind.—It is reported that Henry B. Hulet, City Clk., will soon receive bids for paving with vitrified brick on W. Main St.; also for cement sidewalks on Jefferson St. and Wabash Ave.

Bloomfield, Ind.—It is reported that bids will be received until June 10 by the Bd. Co. Comrs. for constructing a gravel road in Spafford Township; W. H. Deckard, Co. Aud.

Indianapolis, Ind.—Bids will be received until June 12 by the Bd. Pub. Wks. (M. A. Downing, Pres.) for constructing cement sidewalks on portions of 5 streets.

Clinton, Ia.—Paving to the amount of 50,000 sq. yds. has been ordered reconstructed with brick, but some of the Council favor surfacing with asphalt. Chas. P. Chase, of Iowa Engr. Co., is City Engr.

Mayfield, Ky.—*See* "Sewerage and Sewage Disposal."

New Orleans, La.—The following bids are stated to have been opened on May 22 by the Finance Com. for paving with asphalt a portion of *a* Prytania and *b* Baronne Sts.: Barber Asphalt Paving Co., *a* $1.97, *b* $2.12, and Louisiana Improvement Co., *a* $2.12, *b* $2.10.

Highlandtown, Md.—H. G. Shirley, of Towson, Road Engr., writes that the following are the bids opened May 25 for paving Clinton St. in Highlandtown: (*a*) Snyder & Padgett, Baltimore, $26,135 (Porter block to be used); (*b*) Nardin & Bresnan, Baltimore (2 bids), Porter block, $24,759 and Maxwell block, $23,666.

	a	*b*
6,398 cu. yds. excav., 8-in.	$0.30	$0.47
10,923 sq. yds. rolled gravel found., 8-in.	.40	.37
4,272 lin. ft. Armour concrete curb, 5x20-in.	.65	.47
10,923 sq. yds. vit. pavt., sand cushion, concrete fill.	1.55	1.43 and 1.33
550 lin. ft. old curb reset	.25	.15

Elkton, Md.—Bids will be received June 6 by the Bd. Co. Comrs. (Levi E. Patterson, Pres.) for grading and macadamizing about 1 mile of the Rising Sun-Farmington Road.

Frederick, Md.—Bids will be received by the Mayor and Bd. Aldermen until June 12 for laying approximately 5,587 sq. yds. vitr. fire-clay block, or vitr. shale block pavt., and furnishing and setting approximately 2,230 lin. ft. straight dressed granite curb, on Patrick and Market Sts.; Oscar B. Coblentz, Engr., Frederick. Geo. E. Smith, Mayor.

**Baltimore, Md.*—B. T. Fendall, City Engr., writes that the following are the bids opened May 31 by the Bd. of Awards for grading portions of St. Paul St. and Merryman's Lane, 60,970 cu. yds. excav., price given per cu. yd. (Bidders of Baltimore, unless otherwise mentioned): Navdin & Bresnan, 43 cts.; Daniel Sullivan & John C. Leonard, Station D, 37 cts. (awarded contract); McGovern Constr. Co., Trenton, N. J., 38 cts.; F. E. Schneider & Co., 38 cts.; The Jas. F. McCabe Co., 45 cts.; Patrick Keelty, 44 cts.; P. F. Reddington, 41 cts.

Chelsea, Mass.—A special loan of $40,000 for street improvements has been passed by the Bd. of Aldermen and has been approved by the Mayor. Work will be commenced at once, consisting of granite block and brick paving.

**West Boylston, Mass.*—The H. Gore Co., of Boston, has secured the contract for surfacing with broken stone Sect. Nos. 1 and 2 of highway, West Boylston and Boylston, bids opened by the Metropolitan Water Bd. at Boston, May 19. He bid on both sections for shaping of road beds, 14,597 lin. ft., at 4½ cts. per lin. ft. and for broken stone in place, 9,200 tons, $1.73 per ton. The totals of bids received were as follows (*a*) Sect. No. 1 (*b*) Sect. No. 2: The H. Gore Co., Boston, *a* $7,212, *b* $9,361; The Lane Quarry Co., Hingham, *a* $7,254, *b* $9,564; Newell & Snowling Constr. Co., Uxbridge, *a* $7,924, *b* $10,285; Bruno & Milano, Boston, *a* $8,254, *b* $10,968; Rowe & Perini, South Framingham, *a* $8,768; and Nawn & Brock, Boston, *a* $8,918, *b* $11,460.

Grosse Pointe, Mich.—See "Sewerage and Sewage Disposal."

Detroit, Mich.—The following bids are stated to have been opened on May 23 by the Pub. Wks. Dept. for constructing a municipal portable asphalt plant: Hetherington & Berner, of Indianapolis, Ind., $10,750, and John P. Cowing, of Cleveland, O., 4 bids ranging from $9,500 to $13,800.

**Red Jacket, Mich.*—N. F. Kaiser, Village Clk., writes that the contract for paving streets with Metropolitan brick (bids opened May 25) has been awarded to P. McDonnell, Duluth, Minn., for $41,011, and for concrete walks and combined curb and gutter to R. Blome & Co., Chicago, Ill., for $22,805.

Saginaw, Mich.—Bids will be received until June 8 by the Bd. Pub. Wks. (Andrew J. Lynd, Clk.) for paving and repaving portions of Carroll, Baum, 5th and Hancock Sts., requiring in all about 5,490 sq. yds. asphalt and 3,385 sq. yds. brick pavement, 2,775 lin. ft. Berea and 1,050 lin. ft. Medina curb, 780 lin. ft. combined curb and gutter, etc.

Great Falls, Mont.—The City Council is reported to have under consideration material for repaving of Central Ave, to replace cedar block paving.

Hoboken, N. J.—It is stated that bids will be received until June 14 by the Mayor and Council for regulating, grading, setting curb, and repaving the roadway with the present Belgian block pavement on a portion of Madison St. Jas. H. Londrigan, City Clk.

**Paterson, N. J.*—Contracts for paving Bank, Clark, De Grasse, Grand, Hamilton, Marshall, Ryerson and Union Sts., and Hamburgh and Park Aves. and Lee Pl. with Bermudez asphalt, has been awarded to John R. Lee, Second National Bank Bldg., Paterson, and the contract for paving Bway. from E. 33d St. to Passaic River, with asphaltic macadam to the Barber Asphalt Paving Co., Strauss Bldg., Newark.

Long Island City, L. I., N. Y.—Bids will be received June 12 by Jos. Cassidy, Pres. Boro. Queens, for regulating, grading, curbing and paving portions of several streets. Engineer's estimate: 12,400 sq. yds. asphalt block; 29,060 cu. yds. concrete curb, furnished and set; 40,100 sq. ft. cement sidewalks; 102,100 sq. ft. new flagstones; 7,200 lin. ft. new bluestone curb, furnished and set; $4,460 sq. ft. new bluestone bridging; 1,800 cu. yds. concrete, including mortar bed; 75,100 cu. yds. earth excav., etc.

Bids will be received until June 12 by Jos. Cassidy, Pres. Boro. Queens. for furnishing material and regulating, grading, curbing, flagging and laying sidewalks on portions of several streets. Engineer's estimate: 75,450 sq. ft. cement sidewalks, 20,000 sq. ft. bluestone flag., 15,400 lin. ft. cement curb, 4,000 lin. ft. bluestone curb, etc.

Bids will be received until June 12 by Jos. Cassidy, Pres. Boro. of Queens, for furnishing material and regulating, grading, curbing, repaving, paving and laying sidewalks on portions of several streets. Engineer's estimate: 48,950 sq. yds. wood block, 34,500 sq. yds. asphalt block and 3,200 sq. yds. asphalt pavt., 32,380 sq. yds. macadam to be prepared as foundation, 26,370 lin. ft. new bluestone curb, 6,000 sq. ft. cement sidewalk, 15,300 sq. ft. new flag., etc.

New Brighton, S. I., N. Y.—The only bid received and opened May 23 by Geo. Cromwell., Pres. Richmond Boro. for paving portions of Bard and Davis Aves. was submitted by the Hastings Pavement Co., 25 Broad St., N. Y. City, at the following bid: 6,030 sq. yds. asphalt block, $1,28; 240 sq. yds. belgian block, $2; 1,340 cu. yds. concrete, $5.20; 4,670 lin. ft. 16x4-in. curb, 50 cts.; 6,950 lin. ft. old curb, reset, 10 cts. 345 lin. ft. 20x5-in. curb, 75 cts.; 50 sq. ft. flag, 30 cts.; 630 sq. ft. new bridgestone, 70 cts.; total, $18,949.

The lowest bid opened same time and place for paving Post Ave. with asphalt block on concrete foundation, was submitted by the Barber Asphalt Co., 114 Liberty St., N. Y. City, as follows: 8,200 sq. yds. asphalt block, $1.49½ 1,200 cu. yds. concrete, $3.87; 3,700 lin. ft. new curb, 16x5 in., 77 cts. total, $19,771. The only other bid received was from the Hastings Pavement Co., N. Y. City, for $20,447.

Syracuse, N. Y.—The following bids are stated to have been received May 23d for paving portions of *a* Pearl St., *b* Tallman St., *c* Catharine St., 1 with brick, 2 with asphalt: Central City Paving Co., *a*-1 $6,349, *a*-2 $5,896, *b*-1 $10,931, *c*-1 $857; John Davin, *a*-1 $6,000, *b*-1 $10,544; Wm. H. Phillips *a*-1 $6,003, *b*-1 $10,303; C. T. Hookway, *a*-1 $5,647, *b*-1 $9,770; Thos Marnett, *a*-1 $6,175; *b*-1 $10,814; John Bustin, *a*-1 $6,168, *b*-1 $10,472; *c*-1 $896; Troy Pub. Wks. Co., *a*-1, $5,850; F. J. Baker *a*-2 $6,011, *b*-2 $10,320, and Warner Quinlan Co., *a*-2 $5,991, *b*-2 $10,113.

The contract for paving with Syracuse brick on a portion of E. Fayette St. is stated to have been awarded to John W. Bustin for $18,817.

**Wellsville, N. Y.*—R. H. Lee, City Engr., writes that R. W. Hensen, of Geneva, has secured the contract for paving with brick S. Main St. (bids opened May 9) for $21,828. For detail list of bids received for this work see issue of The Engineering Record May 27.

Troy, N. Y.—Bids will be received by the Bd. Contract and Supply (Jas. M. Riley, Clk.) until June 6 for paving a portion of 7th Ave. with granite blocks upon a gravel and sand foundation; John Flynn, Jr., City Engr.

**Rochester, N. Y.*—Chambers & Grady are stated to have received the contract for paving a portion of Flint St. with Johnsonburg brick for $14,800.

**Binghamton, N. Y.*—L. L. Meeker is stated to have received the contract for curbing Court St. with cement at 33⅓ cts. per yd.

The Common Council is stated to have opened on May 22 bids for paving with vitrified brick about 8,227 sq. yds. on *a* Exchange St., 6,000 sq. yds. on *b* Court St., and 2,742 sq. yds. on *c* Susquehanna St.; price given on various kinds of brick: McGreevy Constr. Co., of Ithaca, *b* (11 bids) $1.64 to $1.97, *a* and *c* (14 bids) $1.64 to $1.97; Jas. M. Homer, *a*, *b* and *c* (2 bids) $1.73 and $1.92; Arthur D. Osborn, 150 Beethoven St., *a*, *b* and *c* (9 bids) $1.77 to $1.85; M. I. Ford, of Binghamton, *a*, *b* and *c* (6 bids) $1.79 to $2.10; M. C. Tyne, *a*, *b* and *c* (6 bids) $1.71 to $1.83; Mulderry Bros., of Albany, *b* (3 bids) $1.75 to $1.90, *a* and *b* (4 bids) $1.68 to $1.90.

Buffalo, N. Y.—The lowest bids received May 19 by the Dept. Pub. Wks. are stated to have been as follows: German Rock Asphalt Co., Virginia St., $9,229; Fox St., $5,290; Washington St., $8,600, and Herman St., $1,544.

**Items marked thus give the names of parties awarded contracts.*

Schenectady, N. Y.—The Common Council is stated to have passed an ordinance providing for the grading, paving and curbing a portion of Elmer Ave.

Painesville, O.—H. P. Cummings, City Engr., writes that all bids opened May 23 for 2,177 sq. yds. brick paving have been rejected and new bids will be received June 13.

Glendale, O.—Bids will be received June 23 by the Bd. Co. Comrs., at Cincinnati, for improving intersection of Springfield and Princeton Pikes in Glendale; Eugene L. Lewis, Co. Aud.

Newark, O.—The following are the bids opened May 26 by the Bd. of Pub. Service for paving Woods Ave.: Brennan & Nutter, Newark, 2,853 sq. yds. brick pavt., 8-in. gravel foundation, 2-in. sand cushion, sand filler, $1.55; 1,655 lin. ft. sandstone curb, 45 cts.; 1,655 lin. ft. artificial stone curb, 29 cts., and 118 lin. ft. edging, 47 cts. W. S. Pace, of Newcomerstown, bid for same 99 cts., 45 cts., 55 cts., and 45 cts.

**Toledo, O.*—The contract for paving a portion of Bancroft St. with kreodone blocks is stated to have been awarded to Russell & Jennison for about $18,812.

Steubenville, O.—Bids will be received June 23 by the Bd. Pub. Service (T. W. Vance, Clk.) for furnishing material and curbing and paving on a portion of 6th and 7th Sts.

Delaware, O.—Bids will be received by the Bd. Pub. Service (F. D. King, Clk.) until June 22 for improving portions of Sandusky and Winter Sts. with vitr. brick or block, asphalt block, creosote wood block, or bitulithic pavt., and curbing with sandstone; bids on labor and material submitted separately.

Cincinnati, O.—Bids will be received until June 7 by the Bd. Pub. Service (Geo. F. Holmes, Clk.) for furnishing materials and macadamizing a portion of Kellogg Ave.

Bids will be received June 26 by the Bd. Pub. Service (Geo. F. Holmes, Clk.) for furnishing materials, grading, curbing and paving with granite blocks, a portion of 2d St.; also with bitulithic on a portion of Pioneer St.

**Warren, O.*—J. Hassler, Clk. Co. Roads Comrs. Dist. No. 1, writes that the contract for constructing 13½ miles of limestone macadam road in this district (bids opened May 23) has been awarded to V. Mango & Co., of Niles, for $47,765.

Terrace Park, O.—It is stated that bids will be received until June 16 by the Village Council for constructing cement or artificial stone sidewalks on Rugby, Amherst and Miami Aves. Jas. W. Sibley, Village Clk.

Lisbon, O.—It is stated that bids will be received until June 16 by the Co. Comrs. for grading Calcutta Road.

Panama.—Bids will be received until June 24 by the Isthmian Canal Comn., Washington, D. C. (Maj. H. J. Gallagher, Purchasing Agt.) for furnishing 3,000,000 paving brick.

Pottstown, Pa.—The Town Council has decided to pave King St. with vitrified brick, 12,000 yds. Ralph E. Shaner, Boro. Engr.

Tamaqua, Pa.—Bids are wanted June 6 for paving a portion of Mauch Chunk St., about 2,500 sq. yds., with vitr. shale paving brick or block on a cement concrete foundation, as advertised in The Engineering Record.

Butler, Pa.—Bids will be received June 6 by the Town Council (H. E. Coulter, Secy.) for grading, curbing and paving portions of Race St. and 4th Ave.

Chattanooga, Tenn.—See "Sewerage and Sewage Disposal."

Richmond, Va.—The contract for paving with asphalt blocks on Grace, Franklin, 3d and Capitol Sts. is stated to have been awarded to the Washington Asphalt Block & Tile Co., Washington, D. C., at $2.18 per sq. yd., or a total of about $50,000.

Tacoma, Wash.—The lowest bid opened on May 22 for asphalt paving on N. 4th and 5th Sts. was submitted by Geo. Milton Savage, of Tacoma, for $11,387.

Marinette, Wis.—M. H. Maxwell, City Clk., writes that bids are wanted June 19 for paving Main St. with brick.

Calgary, Alta., Can.—See "Water."

POWER PLANTS, GAS AND ELECTRICITY.

Notes Arranged Alphabetically by States.

Warren, Ark.—The Warren Light & Water Co. is reported incorporated, with a capital of $12,000, to construct an electric light and power plant. Fred. L. Purcell, Pres.; Carl Hollis, Secy.

Fresno, Cal.—The San Joaquin Light & Power Co. is reported incorporated with a capital of $3,000,000, by H. W. O'Melveny, of Los Angeles; Abraham Haas, of San Francisco, and others. It has taken over the plant of the San Joaquin Power Co., at Fresno, and proposes developing the water power of San Joaquin River and supplying Fresno and surrounding territory with light and power.

Ione, Cal.—The Ione Electric Light & Power Co. is reported incorporated, with a capital of $30,000, by Chas. Erickson, John Hancock and others.

Truckee, Cal.—The plant of the Truckee Electric Light & Power Co. is reported to have been destroyed by fire.

Washington, D. C.—The following are the bids opened May 20 by Lieut. Col. Smith S. Leach, Corps Engrs., U. S. A., for furnishing and installing complete an electric light plant for the Washington filtration plant. There were bids submitted on 4 different classes of work, as follows: (*a*) For complete lighting plant, including ducts, manholes, drains, engines and generators, foundations, switchboard, leads and wiring, etc., (*a* includes all of classes b, c and d); (*b*) for engines, generators, switchboard, and all necessary leads and wiring between generators and switchboard, all foundation bolts, etc.; (*c*) for ducts, duct manholes, drainage system from manholes, etc., including all labor to install a complete duct system; (*d*) for all wiring in filter beds, buildings, and courts, all cables in ducts, tablet boards, tubing, fittings, arc lamps, poles, etc., not included in classes *b* and *c*: Edmund Saxton, Washington, *c* $11,000; Brennan Constr. Co., Washington, *c* $7,544; Malcolm W. Hill & Co., Baltimore, Md., *a* $57,990, *b* $6,750, *c* $13,906, *d* $37,923; J. F. Buchanan & Co., Philadelphia, Pa., *a* $56,400, *b* $4,600, *c* $8,500 *d* $44,600; B. F. Sturtevant Co., Hyde Park, Mass., *b* $7,377; Johnston Livingston, Jr., & Co., New York, N. Y., *a* $61,275, *b* $6,846, *d* $36,444; McCay Engr. Co., Baltimore, Md., *a* $53,987, *b* $6,089, *c* $11,549, *d* $37,912; Westinghouse Elec. Mfg. Co., Baltimore, Md., *b* $6,025; E. S. Marlow, Washington, *c* $12,606; National Electric Supply Co., Washington, *a* $51,449, *b* $6,698, *c* $12,452, *d* $32,299; Thos. W. Power, Washington, *b* $6,069.

Bids will be received June 14 by Elliott Woods, Supt. Bldgs. and Grounds, for furnishing electric light fixtures for the House and Senate wings, U. S. Capitol; for the reconstruction of the skylights over the Senate and House of Representatives, and for building materials, such as cement, building concrete, sand, broken stone, gravel and bricks for the construction of the Senate and House office building.

Bids will be received until June 20 at the Bureau Supplies and Accounts, Navy Dept., Washington, for furnishing at the navy yards, Mare Island, Cal., and Puget Sound, Wash., a quantity of supplies as follows: incandescent and arc lamps; insulating rings; forming, burring, crimping, nut facing, slotting, molding, sanding and pipe threading machines; turbine pump; forges; anvils, etc.; H. T. B. Harris, Paymaster Gen., U. S. N.

Bids will be received until June 13 by the Bureau of Supplies & Accounts for furnishing naval supplies, including electrical supplies, wire cable, cement, sewer pipe, etc. H. T. B. Harris, Paymaster Gen., U. S. N.

Tallapoosa, Ga.—The citizens are reported to have voted May 24 to grant Gelder & Black a franchise for an electric light plant.

Wynnewood, Ind. Ter.—J. H. Boozer, City Recorder, writes that it is proposed to vote on issuing bonds for the construction of water works and an electric light plant, but nothing definite has been done, except to appoint a committee to figure cost, etc.

Albia, Ia.—Levi S. Davis is stated to have secured a franchise for a gas plant.

Chetopa, Kan.—The citizens are reported to have voted to issue bonds for water works and electric light plant.

Owensboro, Ky.—The Owensboro Gaslight Co. is reported to have decided to expend about $150,000 in improvements.

Baltimore, Md.—Bids will be received June 7 by the Bd. of Awards (E. Clay Timanus, Pres.) for supplying Bay View Asylum with one 150-h.p. simple automatic cut-off engine; Chas. E. Phelps, Jr., Ch. Engr., Electrical Comn., City Hall.

Ellicott City, Md.—Victor G. Bloede, of Baltimore, Treas. Patapsco Electric & Mfg. Co., writes that it is proposed to construct a plant on Patapsco River below Ellicott City, for the purpose of generating electric current for light and power. The approximate capacity of the power plant will be about 900 h.p. The design of the building has not yet been made, nor has the make of machinery been decided upon.

Ft. Warren, Mass.—Bids will be received until June 19 by Maj. John E. Baxter, Q. M., U. S. A., Boston, for furnishing materials and installing a system for interior and exterior electric lighting, with fixtures and lamps ready for use.

**Springfield, Mass.*—Fred. T. Ley & Co., of Springfield, is stated to have secured the contract for constructing 12 miles of gas pipe for the Springfield Gas Light Co., for about $10,000.

Trenton, Mich.—The village electric light plant and water works is reported to have been destroyed by fire May 28. D. W. Peaume, Ch. Engr.

Bird Island, Minn.—J. H. Feeter, City Recorder, writes that the citizens voted May 23 to construct a gas plant, to cost about $6,000.

Durant, Miss.—J. G. Hamilton, Mayor, writes that it is proposed to replace the present electric light plant with a larger plant at a cost of $12,000, and bids for construction will be received about July 3.

Wisner, Neb.—The Village Clk., writes that bids will be received June 26 for the purchase of $9,000 bonds, to be used for the construction of a lighting plant. It has not yet been decided what kind of a lighting plant will be constructed.

**Kearney, Neb.*—J. L. McBrien, of Lincoln, Secy. State Bd. Educ., writes that Kuntzer & Isdell, of Kearney, has secured the contract for erecting a power house on the grounds of the State Normal School at Kearney (bids opened May 24) for $9,283.

Dodge, Neb.—It is reported that bids are wanted June 15 for the purchase of bonds, $8,000 for water works and $2,000 for an electric light plant.

**Keene, N. H.*—The contract for lighting the streets has been awarded to the Citizens' Electric Co., of Keene, at $82.50 per yr. for a 410-watt arc light and $21 per yr. for 32-c.p. incandescent lights for an all-night, every-night service.

Kearny, N. J.—Bids will be received until June 14 by the Mayor and Town Council for furnishing material and erecting a municipal electric lighting plant. Separate bids are to be submitted on the following: Power house and foundation, chimney and breeching, boilers and steam fittings, engines, generators and exciters, switchboard, wiring, transformers, pole line and fixtures, arc lamps. The cost of the plant is estimated at $55,000; Runyon & Carey, 122 Market St., Newark, are the engineers; T. C. Wildman, Town Clk.

Paterson, N. J.—The Paterson Electric Light, Heat & Power Co. has petitioned Council for a franchise for an electric light plant.

**Niagara Falls, N. Y.*—The John Schaff Contr. Co., of Buffalo, is reported to have secured the contract for building a transformer house for the Niagara, Lockport & Ontario Power Co., for $25,000.

Ellis Island, N. Y. Harbor, N. Y.—It is stated that bids will be received until June 17 for furnishing at the Immigration Station Ellis Island electrical supplies for the year ending June 30, 1906. Robt. Watchorn, Comdg.

Tonawanda, N. Y.—A $500,000 mortgage is reported to have been made by the Niagara Light, Heat & Power Co., of Tonawanda, to be used to take up outstanding bonds and make extensive improvements in Tonawanda.

Potsdam, N. Y.—Bonds to the amount of $40,000 are about to be sold, to be used for the construction of an electric light plant. Engineer, H. B. Sweet, of Utica.

**Binghamton, N. Y.*—The Council is stated to have on May 22 awarded to the Binghamton Light, Heat & Power Co., the contract for lighting the streets at 23 cts. each night for a term of 3 yrs. for 374 arc lights, and for lighting the city hall and other city property at 6 cts. per each kw.

Buffalo, N. Y.—The Consumers' Power Co., of Buffalo, has been incorporated with a capital of $200,000, to supply electricity for light, heat and power. Directors J. S. Lambert, Fredonia; Eugene L. Falk and F. H. Williams, both of Buffalo.

The Pioneer Gas & Electric Co. is reported incorporated with a capital of $300,000 by Wm. F. Carroll, F. V. Barnes, Geo. Clinton, Jr., of Buffalo, and others.

Oswego, N. Y.—The Oswego Light & Power Co. is reported incorporated, with a capital of $100,000, to operate in Oswego, Onondago, Oneida, Madison, Cayuga, Seneca, Wayne, Monroe and Jefferson counties. Directors: Henry B. Brewster and Saml. A. Fulford, of Syracuse.

Dunn, N. C.—J. Pearsall, City Clk., writes that contracts will be let after June 20 for enlarging the electric light plant, at a cost of $2,000.

Burlington, N. C.—Bids are wanted until June 15 for $10,000 city electric light bonds; O. F. Crowson, Secy., Burlington.

**Cincinnati, O.*—Contracts are stated to have been awarded by the Cincinnati Gas & Electric Co. for the improvement of the West End works as follows: Retorts, Parker Russell Mfg. Co., of St. Louis, Mo., $130,000; stoking machines, G. A. Bronder, of New York, N. Y., $30,000; structural steel, the American Steel Co., New York, N. Y., $80,000, and another for structural steel to Brown, Ketchum & Co., New York, N. Y., $26,000; carpenter and roofing work, L. P. Hazen & Co., Cincinnati, $16,000.

Newark, O.—Electric light improvement bonds to the amount of $15,000 are reported sold.

Forest, O.—The City Clk. writes that it is proposed to construct an electric light plant, to cost from $5,000 to $8,000.

Whitemarsh, Pa.—The Wissahickon Electric Co. is reported formed with a capital of $10,000 by Saml. S. Alderfer, of Souderton; J. Milton Brooke, of Edge Hill, and others, to supply light, heat and power in Whitemarsh Township.

York, Pa.—Press reports state that Bertram, Storrs & Griscom, of New York, N. Y.; Lee, Higginson & Co., of Boston, Mass., and other banking interests have financed the project of constructing a power plant on the Susquehanna River at McCalls Ferry.

Wilkesbarre, Pa.—The Wilkesbarre Gas & Electric Co. contemplates improving its plant to include changing from D. C. to A. C., adding 1,350 kw. to station capacity, including one Curtis turbine, also changing from non-condensing to condensing.

Armour, S. D.—Fred. L. Kellogg is stated to have secured a franchise for a lighting and heating plant.

Bolivar, Tenn.—The City Clk. writes bids are wanted June 15 for the construction of water works and an electric light plant, to cost $20,000.

Del Rio, Tex.—The Del Rio Electric Light & Ice Co. is reported incorporated with a capital of $20,000, to install and operate an electric light and ice plant. Incorporators: J. D. Darden, of Jericho; John M. Gray, of Del Rio, and Maynard Gunsul, of Albuquerque, N. M.

Garden City, Utah.—The Council is reported to be considering the issue of bonds for the construction of an electric light plant.

Fredericksburg, Va.—The citizens are reported to have voted to issue bonds for the construction of new gas works.

Spokane, Wash.—A contract for preliminary work on buildings for new gas plant is reported to have been let to Nicholas Norman by W. R. Sainsbury, of New York. Architect Albert Held, Hyde Blk., who has prepared the plans, estimates the cost of the work at $125,000. The buildings will be of brick, including an office fronting on Erie St., 1 story, 30x30 ft.; retort house, 40x100 ft., 3 stories; boiler house and exhaust room, 40x60, 1 story; purifier house, 35x60 ft., 3 stories; workshops and storehouse, 1 story, 25x50 ft. These will be of steel construction with fireproof floors. There will be a 3-lift steel cylinder gas holder of 300,000 cu. ft. capacity; tar well 25 ft. in diam., 10 ft. deep; coke pavilion for storage, 50 ft. in diam., and coal bunkers with capacity of 2,000 tons.

Green Bay, Wis.—The Green Bay Gas & Electric Co. is stated to have decided to expend about $200,000 in improvements.

**Rhinelander, Wis.*—The Allis-Chalmers Co., of Milwaukee, has secured the contract for furnishing for the Rhinelander Power Co., which proposes developing water power on Wisconsin River, the entire electrical equipment, which includes three 400-k.w., 1,100-volt, 3-phase, 60-cycle generators, with three 70½-k.w., 120-volt separately driven exciters, six 150-k.w., 10,000-volt transformers and complete switchboards at both the generating station and the sub-station at Rhinelander. The current will be carried 11,000 volts over a single 3-phase circuit to the sub-station at Rhinelander, a distance of about 6½ miles.

ELECTRIC RAILWAYS.

Notes Arranged Alphabetically by States.

San Jose, Cal.—It is stated that the San Jose & Los Gatos Interurban Ry. Co. will soon extend the line north to Palo Alto. O. N. Hale, Pres.

Atlanta, Ga.—It is stated that the Atlanta Constr. & Development Co. proposes constructing an electric railway from Atlanta to Macon. Chas. J. Canfield, of Chicago; Geo. W. Swigart, of Manistee, Mich.; Thos. B. Felder, of Atlanta., are reported interested.

Peoria, Ill.—The Peoria, Pekin & Bloomington Interurban Ry. Co., of Pekin, is reported incorporated, with a capital of $100,000, to construct an electric railway from Peoria, through Tazewell and McLean Counties, to Bloomington. Incorporators: Levi Johnston, Danvers; F. E. Seagrace, Toledo; Jesse Black, Jr., Pekin; D. B. Brown, Peoria, Ill., and others.

Bunker Hill, Ill.—The St. Louis & Eastern Electric R. R. Co. is stated to have in contemplation the construction of a line from East Alton to Litchfield. J. H. Belt, Jr., of Bunker Hill, Pres.; H. R. Budd, Secy.; C. E. Drew, Treas.

**Items marked thus give the names of parties awarded contracts.*

Columbia City, Ind.—The Huntington, Columbia City & Northwestern Electric Ry. Co. is stated to have awarded a contract to the American Engineering Co., of Indianapolis, for the construction of its line.

Chickasha, I. T.—Julius E. Wright, S. Howard Leach and J. A. Bohart are stated to have received a franchise to build an electric railway in Chickasha. The company plans to run the road from Chickasha to several other nearby towns and eventually to Oklahoma City.

Danville, Ky.—Preliminary surveys are stated to have been made by the Creelsboro & Danville Electric Ry. Co. for a road between Creelsboro, Tenn., and Danville.

Springfield, Mass.—The Springfield St. Ry. Co. is stated to have received franchise for extending the line to Bircham Bend and Chicopee Falls.

**Worcester, Mass.*—The Worcester Consolidated St. Ry. Co. is stated to have awarded the contract for the construction of the line from Leominster to Worcester through Sterling and West Boylston to J. G. White & Co., of New York, N. Y.

Monroe, Mich.—The Westinghouse Electric & Mfg. Co. is reported to be preparing plans and estimates for a 17-mile line from Monroe to Dundee for the Detroit, Monroe & Toledo Short Line.

Moorhead, Minn.—S. W. Wheeler, of the Wheeler Land Co., of Moorhead, is reported interested in the proposed construction of an electric railway to run from Crookston to Grand Forks and Fargo. The line will be 90 miles long.

Hannibal, Mo.—The building of the electric railway from Hannibal to Kirksville, Mo., is reported under consideration. Messrs. Ogden and Carter are the promoters. The proposed line is 80 miles long. According to present plans, the line, if built, will touch Oakwood, Palmyra and Warren and Shelbyville.

Jefferson City, Mo.—The St. Louis & Fenton R. R. Co. is stated to have been incorporated with a capital of $12,000, to build an electric railway from Carondelet to Fenton, the line to be 12 miles in length. Incorporators: E. J. Thurman, John B. Clayton, A. F. Fisher and others.

New York, N. Y.—The Bronx, Yonkers & White Plains Ry. Co. is stated to have in contemplation the construction of an electric railway from the Bronx to White Plains and Yonkers. F. V. Millard is reported interested.

Staten Island, N. Y.—It is reported that the Baltimore & Ohio R. R. Co. contemplate spending in the immediate future about $2,000,000 in improvingg the Staten Island lines. This included both the shore and Amboy divisions. Although it is not understood that the road is to follow the example of others and electrify.

Batavia, N. Y.—The Union Traction Co. is reported organized to build an electric railway from Batavia to Lake Ontario. The route proposed is by way of Oakfield, Medina and Olcott. The total length of the proposed road is 48 miles. Capital, $600,000.

Auburn, N. Y.—The Auburn & Northern Electric R. R. Co. is reported organized to construct and operate a road 12 miles long from Auburn to Port Byron.

Marcellus, N. Y.—The Marcellus & Otisco Lake Ry. Co. is reported incorporated, with a capital of $200,000, succeeding the old Marcellus Electric R. R. Co. Incorporators: G. M. Brill, of Marion, Pa.; S. S. Merwin, of Bryn Mawr, Pa., and H. R. Bayne, of New Brighton, S. I., N. Y. The line at present is 8 miles long, being constructed from Marcellus, N. Y., south along Nine-Mile Creek to Marietta. It is understood to be the purpose of the new company to extend the line to Otisco Lake.

Shawnee, Okla. Ter.—Alfred Hare is stated to have been granted a franchise by the City Council of Tecumseh to build an interurban electric railway from Shawnee to Tecumseh.

Lexington, Okla. Ter.—The Oklahoma City, Lexington & Sulphur Springs Electric Ry. Co. is stated to have decided to construct an electric railway.

Oklahoma City, Okla. Ter.—The Oklahoma Traction Co., with headquarters at Oklahoma City and a capital of $300,000, is stated to have received a charter to construct an electric railway from Oklahoma City to Lexington, a distance of 40 miles. C. E. V. Eggleston, of Oklahoma City; C. R. Eggleston, of Ft. Smith, Ark.; L. E. Patterson, of Ada, I. T., are reported interested.

Akron, O.—The construction of an electric railway from Akron to Medina is reported contemplated. Chas. Esselburn, of Akron, is reported interested.

Norwalk, O.—The Westinghouse Electric & Mfg. Co. is reported to be preparing plans for the construction and equipment of the proposed Mansfield, Greenwich & Norwalk Ry. The company proposes to build from Mansfield to Norwalk by way of Greenwich.

Newark, O.—The Newark, Martinsburg & Mount Vernon Traction Co., formed to build a line from Newark to Mount Vernon, is reported organized. E. H. Everett, Pres.; J. A. Chilcote, Treas. The same parties are stated to be securing right of way from Mount Vernon to Wooster.

Canton, O.—It is stated that the Canton & Youngstown Ry. Co. proposes to build a line from Canton to Youngstown via Congress Lake, Atwater, Deerfield, Ellsworth and Canfield. It is very probable that a branch line will be built from Congress Lake into Akron. W. H. Clark, Pres.; L. D. Blanchard, Secy.; C. H. Schlaback, Treas., all of Canton.

Toledo, O.—Pfaelzer, Walker & Co., of New York, are reported to be arranging for the financing of the Toledo & Michigan Ry. P. P. Duket, of Toledo, is Pres. The company has obtained franchises and right of way for a line from Toledo to Adrian, Cadmus, Hudson, Hillsdale, Jonesville and other Michigan towns.

**Barton, O.*—The Boldgett Constr. Co., of Wheeling, W. Va., is stated to have received the contract for reopening the line of the Wheeling & Western Ry. from Pasco to Barton. The road has not been in operation on account of landslides and washouts.

Wilmington, O.—The Wilmington, Jamestown & South Solon Ry. Co. is reported incorporated by A. J. Wilson, B. F. Patterson, J. V. Baird and others. It is proposed to build a line from Wilmington to Jamestown and South Solon.

Galion, O.—It is stated that the Galion & Southern Ry. Co. has under consideration the construction of an electric railway from Galion to Fredericktown.

Youngstown, O.—It is stated that the stock held by the promoters of the Youngstown & Southern Ry. Co. has been purchased by a syndicate composed of Youngstown men. The road will be completed as an interurban electric. The company has been operating about 16 miles of track by steam. Work will be commenced in a short time on a line, which, when completed, will connect East Liverpool, Salem, Lisbon and Leetonia with Youngstown. John Stambaugh, Youngstown, Pres.; F. D. Wilkerson, Youngstown, Secy., and Treas.

The Lake Erie, Mahoning & Southern Ry. Co. is reported to have decided to construct a freight line from Youngstown to Salem by way of Canfield and Calia. Allen Kirkbride and Thos. McNamara, of Youngstown, are reported interested.

The Pennsylvania & Mahoning Valley Ry. Co. is reported to be preparing to build an extension from New Castle to West Pittsburg, Pa.

Fremont, O.—It is stated that the Columbus, Fremont & Lake Erie Ry. Co. will construct an electric railway from Marion to Lake Erie by way of Upper Sandusky, Tiffin and Fremont. J. N. Gardner, of New York, is reported interested.

Mansfield, O.—It is stated that the Wooster & Mansfield Interurban Ry. Co., which proposes to build from Mansfield to Wooster, is considering the advisability of using gasoline motor cars. It is thought the road can be built and equipped in this manner for $700,000, whereas the engineer's estimates for electric equipment are $1,079,000. David Collier, Pres., Mansfield.

Ebensburg, Pa.—The Northern Cambria St. Ry. Co. is reported incorporated, with a capital of $120,000. The line will be 21 miles long.

Boyertown, Pa.—The Town Council is stated to have granted a franchise to the Boyertown & Palm Electric Ry. Co. This line will connect with the Oley Valley line in the outskirts of Boyertown and will run through Gilbertsville and Swamp to Limerick, where it will connect with the Schuylkill Valley line.

Catawissa, Pa.—A charter is stated to have been granted to the Catawissa & Numidia Electric R. R. Co. The proposed line will extend from Main and 4th Sts., Catawissa, to Numidia, which it is proposed to have it connect with another line that will extend from Numidia to Bear Gap. C. E. Randall, Pres.; Wm. M. Vastine, Treas.

**Towanda, Pa.*—The Chatham & Wallaceburg Electric Ry. Co. is reported organized, with G. W. Kipp, of Towanda, Pres., Treas. and Gen. Supt. Directors are G. W. Kipp, E. F. Kiser and M. E. Lilly, of Towanda, and others. Capital, $500,000. The line will extend from Chatham to Wallaceburg, a distance of 21 miles. The contract for building the new line has been let to the Whalen Constr. Co., of Towanda.

Sunbury, Pa.—The right of way for the extension of the Watsontown, Milton & Lewisburg Electric Ry. to Northumberland is reported to have been entirely secured.

Butler, Pa.—It is stated that the Zelionaple St. Railway Co. will construct an electric railway.

Chattanooga, Tenn.—Samuel D. Divine is stated to have been granted a license by the Secretary of War to build an electric railway through the Chickamauga Park and Ft. Oglethorpe military reservations. The Tennessee-Alabama Interurban R. R. Co., with a capital of $300,000, is to construct the line. Incorporators: S. W. Divine, of Chattanooga; J. H. Walker, jr., J. C. Bryan. The purpose of the new company is to build a railroad from the army post through Chickamauga Park to Ducktown, Tenn., via Ringgold, Catoosa Springs and other nearby points in Georgia.

Knoxville, Tenn.—R. W. Smith, of New York, is reported interested in the plan to build an electric railway to connect Rogersville and Hale Springs. The route of the proposed electric railway is along the Rogersville-Jonesville Pike a distance of 8 miles to Alum Well and from Poor Valley to Hale's Springs, a distance of 12 miles.

Ft. Worth, Tex.—The construction of an interurban electric railway between Ft. Worth and Mineral Wells is reported under consideration. J. D. and C. H. Beasley, of Gibson, La.; G. E. Montgomery and J. L. Breathit, of Shreveport, La., are reported interested.

McKinney, Tex.—It is stated that the Bonham-McKinney Interurban Electric R. R. Co. will construct an electric railway at McKinney. Hunter Woodson is reported interested.

Bluefield, W. Va.—It is stated that the Tannerton Traction & Amusement Co. will build 2½ miles of an electric railway through Bluefield to Tannerton Park. Theron C. Tanner, of Bluefield, Pres.

**Walkerville, Ont.*—Willis F. Brown, Gen. Mgr. Windsor & Tecumsch Electric Ry. Co., has been appointed Ch. Engr. in charge of construction, and he writes that the contract for power equipment has been awarded to the Robb Engr. Co., of Amherst, N. S., and the Westinghouse Electric & Mfg. Co., of Pittsburg, Pa. Five miles of roadway and bridges are complete, and it is the intention to have the road in operation by Sept. 1, 1905.

Hamilton, Ont.—It is stated that the Hamilton Terminal Ry. Co. is reported to have in contemplation the construction of an electric railway in connection with the business of the Hamilton Steel & Iron Co. C. S. Wilcox, A. E. Carpenter and C. E. Doolittle, of Hamilton, are reported interested. Capital, $100,000.

St. Catherines, Ont.—The Canada-Middlesex Ry. Co. is stated to have decided to build an electric railway from the Niagara frontier through St. Catherines, Woodstock and London to Brantford.

Winnipeg, Ont.—It is reported that the Winnipeg, Selkirk & Lake Winnipeg Electric Ry. Co. will soon let the contract for a complete and up-to-date power house, full electric equipment, rolling stock, etc.

RAILROADS.

Notes Arranged Alphabetically by States.

Lonoke, Ark.—A charter has been granted to the Lonoke, Pine Bluff & Southwestern R. R. Co., with J. P. White and Louis Beaman, of Lonoke, John A. Mitchell, of Little Rock, and others, as incorporators, and a capital of $1,000,000, to construct a standard-gauge railroad from a point in Lonoke County to Pine Bluff.

Denver, Colo.—The Denver, Enid & Gulf R. R. Co. (W. D. Gerber, Ch. Engr., Enid, Okla. Ter.) is reported to have completed plans for extending the road to Pueblo and Denver.

**Oglethorpe, Ga.*—Alex. Bonnyman, of Oglethorpe, Ch. Engr., Atlanta, Birmingham & Atlantic R. R. Co., writes that the contract for grading, grubbing and timbering and concrete in tunnel of aoout 20 miles of road (bids opened May 20) has been awarded to The Callahan Constr. Co., of Knoxville, Tenn.

Greenville, Ga.—The Greenville & Newnan Ry. Co. is reported incorporated, to construct a line from Greenville to Newnan, a distance of about 30 miles; capital, $10,000. Incorporators: J. F. Hanson and S. R. Jacques, of Macon; H. C. Cunningham, jr., and T. S. Moise, of Savannah, and others.

Culdesac, Idaho.—Press reports state that the Northern Pacific R. R. Co. (E. J. Pearson, Ch. Engr., St. Paul, Minn.) and the Oregon Short Line (Wm. Ashton, Ch. Engr., Salt Lake City) will build a joint line 500 miles long from Culdesac south by way of the Snake River Valley through the Nez Perces country.

Chicago, Ill.—The directors of the Chicago & Eastern Illinois R. R. Co. (J. F. Hinckley, Ch. Engr., St. Louis, Mo.) are reported to be considering a new issue of bonds, part of which are to be issued for improvements in the system. A new double-track line between Chicago and St. Louis will be part of the improvements.

Chicago, Ill.—The City Council has passed an ordinance providing for the elevation of the tracks of the Illinois Central and Nickel Plate roads from 79th St. to the city limits; Michigan Central to 123d St., and the Chicago & Western Indiana R. R. Co. and the Chicago, Rock Island & Pacific R. R. Co. from State St. past Stony Island Ave.

Huntington, Ind.—C. N. Wilson, of Indianapolis, Pres. of the American Engr. Co., is reported to have secured the contract to finance, engineer and construct the Huntington, Columbia City & Northwestern Ry.

London, Ky.—The Kentucky Southern Ry. Co. is stated to have decided to extend its line from a point near Little Rockcastle River, Laurel County, about 45 miles along the boundaries of Laurel, Rockcastle and Pulaski Counties, across Cumberland River and on to Tateville.

Louisville, Ky.—The Cincinnati, Flemingsburg & Southern R. R. Co. is reported incorporated, with a capital of $125,000, to construct a railroad 17 miles in length to connect Johnson, Flemingsburg, Poplar Plains and Hillsboro, all in Fleming County, Ky. Incorporators: Attilla Cox, S. S. Bush, J. Dudley Winston and others.

Rochelle, La.—The Rochelle & Western Ry. Co., of Monroe, is reported incorporated with a capital of $1,000,000 to construct a line from Rochelle to Winnfield and Harrisonburg. Incorporators: C. H. Denkelman, J. C. Simpson, N. S. Cutright and others.

Clinton, Mass.—The Selectmen are stated to have selected F. T. Bateman, of Clinton, to make plans and surveys for the abolishment of grade crossings in Clinton.

Detroit, Mich.—Plans for the Michigan Central's tunnel under Detroit River here are stated to have been approved by W. S. Kinnear, Detroit, and it is reported that work will be started at once from the Detroit side of the river. The total cost of the work will be about $7,000,000, according to present plans. The tunnel will be built of 2 steel tubes.

Cleveland, O.—The Cuyahoga Valley Ry. Co., of Cleveland, is reported incorporated, by D. B. Meacham, S. W. Croxton, D. T. Croxton and others, to build a railroad to connect in Cleveland the Wheeling & Lake Erie, the Newburgh & South Shore and the Cleveland, Lorain & Western; capital, $10,000.

Cincinnati, O.—Improvements are reported to be in contemplation by the Cleveland, Cincinnati, Chicago & St. Louis R. R. Co. (G. W. Kittredge, Ch. Engr., Cincinnati), to include extensive improvements in the freight terminals at Cincinnati, Columbus and Indianapolis; also a new union station at Springfield, O. The road between Cincinnati and Dayton will to a large extent be double-tracked; also a section south of Dayton and north of Carthage. The remainder of the curves between Cincinnati and Indianapolis will be eliminated and 100 of the 110 miles of this line will be double track; also extensive improvement on the Cairo-Danville line.

Bids will be received June 19 by the Bd. Trus., Cincinnati Southern Ry. Co. (Stanley Ferguson, Secy.), for $500,000 bonds, for terminal facilities and permanent betterments of the line of railway.

**Pittsburg, Pa.*—Jas. G. Corcoran & Co., House Bldg., are stated to have secured the contract from the Wabash Pittsburg Terminal Ry. Co. for the construction of its part of the line to join the Wabash system with the Carnegie Steel Co.'s works. The contract covers the grading and masonry for about 4 miles of single-track line. The cost will be about $200,000.

Pittsburg, Pa.—The construction of an independent freight line from the coal and iron districts of Pittsburg to New York by way of Atglen and the Trenton cut-off is reported to be under consideration by the Pennsylvania R. R. Co. (W. H. Brown, Ch. Engr., Philadelphia).

Nashville, Tenn.—The Nashville, Crocker Springs & Ridgetop Ry. Co. is reported incorporated with a capital of $25,000 by W. J. Cummins, Watkins Crockett, W. C. Dibrell and others, to construct a railway from Nashville through Crocker Springs to Ridgetop.

The Nashville, Crocker Springs & Ridgetop Ry. Co. is reported to have applied for a charter; capital, $25,000. Incorporators: W. P. Ready, W. C. Dibrell, W. J. Cummins and others, and they propose constructing a railroad from Nashville to Crocker Springs, with eventual extension to Ridgetop.

Madison, Tenn.—The Madison & Goodletts R. R. Co. has been incorporated, with a capital of $10,000, by John Bell Keeble, J. W. Judd, E. B. Duval and R. S. Wilcox, to build a line from Goodlettsville to Madison, on the main line between Nashville and Louisville.

Paris, Tex.—The Paris, Deport & Southeastern R. R. Co. is reported organized, with R. F. Scott, Pres., and J. J. Dickerson, Secy., to construct a railroad from Paris to Rosalie; capital, $100,000.

Abilene, Tex.—The Colorado, Texas & Mexico R. R. Co. is stated to have filed an amendment to its charter increasing its capital from $200,000 to $375,000 to pro-

**Items marked thus give the names of parties awarded contracts.*

vide for building a line from a point on Red River south through the counties of Hardeman, Wilbarger, Foard, Baylor, Knox, Haskell, Jones, Taylor, Runnels, Coleman, Concho, McCullough, Mason, San Saba, Llano, Gillespie, Kerr and Kendall to an intersection with the San Antonio and Aransas Pass R. R. at or near Comfort.

**Newton, Tex.*—The contract for the extension of the Orange & Northwestern R. R. Co. from Buna north to Newton, Tex., a distance of 30 miles, is reported to have been awarded to Hammond & Kenefick, of Kansas City, Mo.

Norfolk, Va.—The Norfolk & Carolina Coast R. R. Co. is reported formed, with a capital of $15,000,000, by a syndicate headed by Rudolph Kleybolte & Co., of New York, N. Y. The company will take over timber land in eastern North Carolina and run a railroad from Norfolk through Elizabeth City, Edenton, Belhaven and through the counties of Beaufort, Pamlico, Craven and Carteret, with spurs into Hyde and Tyrell. The southern terminus will be at Beaufort.

Marysville, .. ash.—The Marysville & Northern Ry. Co. is reported incorporated with a capital of $250,000 by C. D. Stimson, F. S. Stimson, Jas. Roe and others, to build or acquire a railroad from a point at or near Marysville, Bryant and northeasterly to some point in Skagit County. It is understood the company proposes to acquire the present Stimson R. R., running north from Marysville, and extend it to Bryant and connect with the road now being operated by the Stimson Mill Co. About 12 miles of the road is to be built at once.

Rosalia, Wash.—The Belcher Mountain Ry. Co. is reported incorporated, with a capital of $100,000, by D. F. Anderson, of Rosalia; E. R. Fraser, of Spokane; J. L. Harper, of Republic, and others, to build a line from Lambert on the main line of the Washington & Great Northern Ry. to the Belcher Mine, a distance of 10 miles.

PUBLIC BUILDINGS.

Notes Arranged Alphabetically by States.

Wynne, Ark.—F. W. Gibb, of Little Rock, Ark., it is stated, has been engaged to prepare plans for the Cross County Court House, which is to be erected here at a cost of about $50,000.

Lake Village, Ark.—It is reported that bids will be received until June 25 by the Co. Comrs. for erecting a court house. Frank W. Gibbs, Archt., Little Rock, Ark.

Los Angeles, Cal.—The Library Bd. has petitioned the City Council to appropriate $500,000 for the erection of a central library and for branches; $350,000 to be for the central building.

San Francisco, Cal.—Bids will be received until July 20 by Jas. Knox Taylor, Superv. Archt., Treas. Dept., Washington, D. C., for erecting the U. S. Custom House at San Francisco. A deposit of $200 is required on drawings and specifications.

Fresno, Cal.—W. H. Ryan, Clk. City Trus., has been authorized to ask for plans for a city hall, to cost $75,000.

Waterbury, Conn.—A bill has passed the Senate authorizing this city to issue $50,000 city hall bonds.

**Wilmington, Del.*—J. M. Phillips, it is stated, has received the contract to erect an addition to the Homeopathic Hospital, the cost to be about $40,000. Wm. D. Brinckle, Equitable Bldg., is the archt.

Washington, D. C.—See "Power Plants, Gas and Electricity."

Washington, D. C.—Bids will be received by the Dept. of Interior (E. A. Hitchcock, Secy.) June 20 for the construction of a new Freedman's Hospital building, as advertised in The Engineering Record.

Lumpkin, Ga.—The Co. Comrs., it is reported, are considering plans for the erection of a jail.

Ft. Screven, Ga.—Bids will be received until June 8 (readvertisement) by Capt. Jos. T. Davidson, Constr. Q. M., U. S. A., Savannah, for constructing hot water heating, plumbing and electric wiring hospital at Ft. Screven.

Pekin, Ill.—The following are the 3 lowest bids opened May 24 by the Superv. Archt., Treas. Dept., Washington, D. C., for steam heating apparatus for the U. S. Post Office at Pekin: Iowa Mfg. Co., Oskaloosa, Ia., $2,399; G. A. Kees Dometer Engr. Co., St. Paul, Minn., $2,539; W. S. Patterson, Appleton, Wis., $2,600.

Kankakee, Ill.—The following are the 3 lowest bids opened May 29 by the Superv. Archt., Washington, D. C., for a low-pressure heating apparatus in U. S. Post-Office at Kankakee: T. M. McGuire, Minneapolis, Minn., $2,055; J. J. Drury, Kankakee, $1,815; and G. A. Kees Domestic Eng. Co., St. Paul, Minn., $1,849.

Wallace, Idaho.—Archts. Stritesky & Sweatt, Jamison Bldg., Spokane, Wash., write that bids will probably be called for about July 1 for erecting the Shoshone County court house; probable cost, $70,000.

Sand Point, Idaho.—It is reported that plans have been completed for a town hall for which a $16,000 bond issue has been authorized.

Dunlaps, Ind.—It is reported that bids will be received by the Co. Comrs. at Goshen, until July 6 for erecting a county hospital at Dunlaps. Address Wm. Whetton, Co. Comr.

Ft. Des Moines, Ia.—Bids are wanted June 15 for constructing, etc., certain buildings at this post, as advertised in The Engineering Record.

Hampton, Ia.—It is reported that bids will be received until June 6 by the Co. Comrs. (P. H. Murphy, Secy.) for enlarging the court house.

**Baltimore, Md.*—The Egerton Orphan Asylum Trus., it is reported have awarded the contract for erecting new asylum buildings on Cedar Ave. to John Cowan, 106 W. Madison St. The buildings are to be of brick, 4 stories high, and the total cost to be about $60,000.

Towson, Md.—Bids will be received until June 16 by the Co. Comrs. at Towson for new concrete and steel cell work, plumbing, window guards, etc., to be furnished and erected in the Baltimore County Jail. Jas. S. Nussear, Jr., Archt., 7 Clay St., Baltimore, Md.

Douglass, Mass.—The erection of a town hall at a cost of about $12,000 is reported under consideration.

South Framingham, Mass.—The Bd. of Trus. of the Framingham Hospital, it is stated, has approved plans for the nurses' home which is to be erected at the hospital at a cost of $20,000.

Fall River, Mass.—John Crowe, of Fall River, it is reported, submitted the lowest bid for repairs to the roof of the court house at $7,900 for copper and $6,266 for slate.

Westfield, Mass.—Gardner & Gardner, of Springfield, it is stated, have prepared plans for a surgical building which is to be erected at the Noble Hospital, the cost to be about $20,000.

Chelsea, Mass.—The Aldermen have passed on second reading the order authorizing the remodeling of the city hall at a cost of $15,000.

Natick Mass.—A bill has been passed over the Governor's veto by the House of Representatives, authorizing this town to incur a debt of $100,000 for a municipal building.

Houghton, Mich.—Plans are being prepared for an armory which is to be erected at a cost of about $20,000.

Mankato, Minn.—It is stated that the Lutheran Evangelical Hospital Assoc., of Southern Minnesota, has secured a site on 4th St. on which it is proposed erecting a new hospital.

Fairmount, Minn.—It is reported that the Co. Comrs. on June 12 will select plans for the court house, which is to cost about $100,000.

Fergus Falls, .. inn.—Vernon A. Wright, it is reported, is arranging to donate a hospital costing $25,000 to the citizens of the city as a memorial of his father, the late Geo. B. Wright.

Chouteau, Mont.—The citizens are reported to have voted May 27 to issue $40,000 bonds for the erection of a court house for Teton County.

Great Falls, Mont.—Geo. Bird, City Engr., is stated to have been authorized to prepare plans for a public bath house, to cost $10,000.

Ft. Niobrara, Neb.—Bids will be received until June 15 by J. E. Sawyer, Ch. Q. M., U. S. A., Omaha, for constructing a barracks, stone or frame, at Ft. Niobrara.

Trenton, N. J.—Bids will be received by the Common Council until June 6 for erecting a hospital in Hamilton Township; Wm. W. Slack, Archt., 18 E. State St., Harry B. Salter, City Clk.

New York, N. Y.—Plans have been filed for a 3-story brick and stone engine house, which is to be erected by the City of New York at 215 W. 58th St., at a cost of $40,000. Alex. Stevens, Archt., 157 E. 67th St.; also plans for a 4-story brick court house, to be erected at 3d Ave. and 161st St., for the City of New York, at a cost of $800,000. M. J. Garvin Archt., 3307 3d Ave.

Bids will be received until June 22 by John F. Ahearn, Boro. Pres., for alterations in rooms on all floors; also for extension to the electric light equipment, plumbing, heating, carpentry and cabinet work, electric lighting fixtures, marble and bronze work, fireproofing and other work for the completion of the Hall of Records, Boro. Manhattan; Horgan & Slattery, Archts., 1 Madison Ave.

Manhasset, L. I., N. Y.—It is reported that the citizens have voted to erect the new town hall for North Hempstead, in this village, the cost to be about $20,000.

Ft. Wadsworth, N. Y.—Bids will be received June 10 by Lieut. Ed. T. Weisel, Q. M., U. S. A., for constructing N. C. O. quarters here.

Port Henry, N. Y.—Bids will be received until June 12 by the Village Trus. (John R. Sherman, Pres.) for $35,000 village hall bonds.

Geneva, N. Y.—The following are the bids opened on May 25 by the Superv. Arch., Treas. Dept., Washington, D. C., for constructing complete U. S. Post Office at Geneva; H. P. Bourgard, Buffalo, $42,987; Thos. Reilly, Philadelphia, $42,330; Carrington Ford Co., Binghamton, $45,800; General Supply & Constr. Co., New York, $35,800; Corning Bldg. Co., Corning, N. Y., $45,134; Fissel & Wagner, New York, $40,923; W. E. Spier, Washington, D. C., $44,500; Richardson & Burgess, Washington, D. C., $38,812; Campbell & Dempsey, Kingston, $50,000; Dunnigton & Co., Rochester, $46,500; J. E. Leamy & Co., Syracuse, $36,960; and A. B. Stannard, New York, $41,940.

**Elmira, N. Y.*—The contract for erecting a laundry, shops and bath house at the Reformatory (bids opened May 1) has been awarded to Scott & Robb, Norwich, N. Y., not including structural steel, heating, plumbing or lighting. The Owego Bridge Co., Owego, N. Y., secured the contract for the structural steel.

Rochester, N. Y.—It is stated that plans have been completed for a fire headquarters building which is to be erected on Central Ave.

**Utica, N. Y.*—The following are reported to be the bids received May 26 by the Co. Bldg. Comn. for the erection of a court house, the bids containing certain modifications: R. Richard & Son, Utica, $805,000; time, 32 months. E. C. Rumrill, Buffalo, $821,350; 28 months. Connors Bros.' Constr. Co., Lowell, Mass., $770,000 (awarded contract); 20 months. Mack & Moore, Boston, Mass., $796,000; 26 months. A. & S. Wilson Co., Pittsburg, Pa., $863,711; 18 months. J. G. Leamy & Co., Syracuse, N. Y., $775,726; 24 months. Buckley Constr. Co., Schenectady, N. Y., $800,000; 18 months. Doyle & Doak, Philadelphia, Pa., $778,443; 22 months. Utica Constr. & Realty Co., $790,000; 24 months; Broderick & Wind Eng. & Constr. Co., New York, N. Y., $815,000; 20 months. P. J. Carlin Constr. Co., New York, $779,000; 360 working days. Griffith & Pierce, Utica, $856,029; 19 months. Denniston & Co., Rochester, N. Y., $739,900; 25 months.

Binghamton, N. Y.—Bids received for a heating plant in the State Armory are reported to have been as follows: Gaylord & Eitapance, of Binghamton, $6,973, and Edw. Joy, of Syracuse, at $8,586.

Raleigh, N. C.—Dr. J. McKee, Supt. State Hospital, writes that new bids will be received June 14 for erecting an annexed wing to the State Hospital. Architect, W. P. Rose, North Carolina Trust Bldg.

Ft. Lincoln, N. D.—Bids will be received until June 16 by Lieut. R. H. Leavitt, Q. M., U. S. A., for constructing, plumbing, heating and electric wiring, brick field officers' quarters, brick double set captains', lieutenants' and N. C. O. quarters, and brick double barracks, here.

Dayton, O.—Bids will be received June 23 by the Bd. Trus., Dayton State Hospital (A. F. Sheperd, M. D., Secy.) for installing a ventilating and heating system in the main building of the hospital.

Tiffin, O.—The Jr. O. V. A. M., No. 136, contemplates erecting a building on the Y. M. C. A. plan to cost about $20,000. Dr. H. L. Wenner, Chmn. Bldg. Com.

Cincinnati, O.—Bids will be received June 27 by the Bldg. Com. Bd. Trus. (Robt. H. West, Chmn.) for erecting a Carnegie Branch Library at Eastern and Donham Aves., including ventilating and heating systems, electric light wiring, plumbing and gas fitting.

Wilkesbarre, Pa.—Contracts will probably soon be let by the city for the erection of a fire engine house. Address, F. Gates, City Clk.

Allentown, Pa.—The following are the bids opened May 31 by the Superv. Archt. Treas. Dept., Washington, D. C., for the construction complete of U. S. Post-Office at Allentown: Fissel & Wagner, New York, N. Y., $80,700; M. J. T. Ochs, Allentown, $107,664; Cramp & Co., Philadelphia, Pa., $84,912; Thos. Reilly, Philadelphia, Pa., $81,610; Wheaton Bldg. Lumber Co., Putnam, Conn., $92,000; Gen. Supply & Constr. Co., New York, N. Y., $83,123.

Norristown, Pa.—Bids will be received until June 10 by the Bldg. Com., State Hospital for the Insane, Southeastern Dist. of Pennsylvania, for erecting 4 temporary ward buildings on the grounds of the hospital. Philip H. Johnson, Archt., 1824 New Land Title Bldg., Philadelphia.

**Providence, R. I.*—The Woodbury Granite Co., of Hardwick, Vt., it is reported, has taken a sub-contract for furnishing the granite to be used in the U. S. Post Office, which is to be erected at Providence at a cost of $300,000.

Memphis, Tenn.—Bids will be received until June 5 (readvertisement) by the Court House Comn. (Levi Jop, Secy.) for $1,000,000 bonds, issued for the purpose of erecting a court house.

Ft. Monroe, Va.—Bids will be received June 24 by Capt. C. P. Townsley, Q. M., U. S. A., for constructing, plumbing, heating and electric wiring 3 single and 1 double officer's quarters, 7 double N. C. officers' quarters, commissary, Q. M. office, and galvanometer house (all of brick) at Ft. Monroe.

Madison, Wis.—A bill has passed third reading in the Legislature authorizing the appropriation of $90,000 for the establishment of a State Sanitarium for Consumptives.

**Manitowoc, Wis.*—Edw. Schaffland, Co. Clk., writes that the following are the bids opened May 23 by the Co. Comrs. for erecting a court house: (*a*) Bedford stone; (*b*) variegated raindrop brick for basement and steps and Bedford No. 1 stone for the rest of the structure: Geo. Brickman & Sons, Kalamazoo, Mich., *a* $154,800; *b* $159,200 (awarded contract); Geo. Boll, Manitowoc, *a* $172,000, *b* $176,000; Albert Tomchek, *a* $168,720, *b* $172,200; Anton Schmidt & Co., Milwaukee, *a* $159,980, *b* $164,930; Gibson & Wolf, Two Rivers, *a* $156,036; Levenhagen, Brackman & Pitz, Manitowoc, *a* $179,000, *b* $183,200; General Constr. Co., Milwaukee, *a* $158,876, *b* $160,394.

Milwaukee, Wis.—The Joint Com. of the County Hospital and Almshouse, it is stated, has accepted the plans of Wolff & Ewens, 558 12th St., for repairs to be made to the county hospital, the cost to be about $12,000.

Ft. Mackenzie, Wyo.—Bids will be received by Capt. Jas. S. Parker, Q. M., U. S. A., Sheridan, on June 15, for constructing building at Ft. Mackenzie, as advertised in The Engineering Record.

**Laramie, Wyo.*—W. H. Maxwell Co., of Pierre, S. D., has secured the contract for constructingg U. S. Post Office (bids opened May 11) for about $70,807.

Woodstock, Ont.—Bids will be received until June 9 by the Dept. of Pub. Wks., Ontario, Toronto (J. O. Reaume, Minister) for erecting 2 cottages at the Hospital for Epileptics near Woodstock, work to include heating, plumbing and electric wiring.

BUSINESS BUILDINGS.

Notes Arranged Alphabetically by States.

Birmingham, Ala.—It is stated that the Caldwell Real Estate & Investment Co., intend erecting a 6-story brick building at First Ave. and 22d St., at a cost of $75,000.

Opelika, Ala.—It is reported that the cotton warehouse of Bartow Smith has been destroyed by fire.

Los Angeles, Cal.—Morgan & Walls, Farmers & Merchants' Bank Bldg., it is stated, are preparing plans for a six-story office building which is to be erected by I. W. Hellman, at 4th and Main Sts.

Denver, Colo.—The Shriners are reported to have purchase a site on 18th St. and Sherman Ave. and will erect a temple to cost about $75,000. R. A. Kincaird, Pres. Eljebel Temple, is reported interested.

Atlanta, Ga.—E. C. Seiz, it is reported, is the archt. and builder for a 6-story hotel which is to be erected for the Empire State Improv. Co. at Walton and Cone Sts. at a cost of $100,000.

East St. Louis, Ill.—Gen Mgr. Jones, of the St. Louis National Stock Yards, is stated to have selected A. B. Frankel, 208 Collinsville ave., to prepare plans and supervise the construction of new Mule Barns at the Stock Yards, to replace those recently destroyed by fire; estimated cost of each barn will be about $32,000.

Tuscola, Ill.—Chas. V. Weise, it is reported, is preparing to erect a $40,000 business building.

Bloomington, Ill.—The erection of a union station here by the Big Four (G. W. Kittredge, Ch. Engr., Cincinnati, O.), the Chicago & Alton (G. H. Kimball, Ch. Engr., Chicago, Ill.), and the Lake Erie & Western R. R. Co. (E. A. Handy, Ch. Engr., Cleveland, O.), at a cost of about $100,000, is reported under consideration.

Diamond, Ind.—It is reported that bids are wanted until June 30 for erecting a lodge building for Prosperity Lodge No. 32, I. O. O. F.; W. W. McCarty, Secy.

Chicago, Ill.—W. Carbys Zimmerman, 21 Van Buren St., it is stated, has prepared plans for a 2-story, 210x215-ft. building which is to be erected at Milwaukee and Powell Aves., for Mrs. Kuhn, the cost to be about $70,000.

L. P. Moore, Treas. Benj. Moore Co., Mfrs. of Paints, etc., writes that it is proposed to erect a 4-story and base-

**Items marked thus give the names of parties awarded contracts.*

ment building, mill constructed, 108x38 ft., but do not contemplate any addition to the present power plant.

The Pioneer Paper Co. and Bradner, Smith & Co. jointly will erect a mercantile building on Ohio St., near Kingsbury. It will be a 7-story mill constructed structure, 100x120 ft., of pressed brick and stone, and cost $160,000. The plans are by Huehl & Schmid, 163 Randolph St..

Plans have been prepared by Huehl & Schmidt, 163 Randolph St., for a laundry and power house for the Schriver Laundry Co., to be built at W. Lake St. and Kedzie Ave. It will be a 2 story, 72x176 ft., and cost $25,000.

Henry L. Ottenheimer, 109 Randolph St., is the archt. for the reconstruction of the building on West Van Buren near Halsted St., which was partly destroyed by fire early in the year. The new building will be 112x100 ft., 6 stories high, of mill construction, and cost $100,000.

Hill & Woltersdorf, 70 La Salle St., are preparing plans for a store, office and hall building to be built at 40th Ave. and W. Madison St., for Judge Lambert Tree. It will be a 3-story structure, 100x75 ft., and cost $60,000. The same architects are preparing plans for a business building, 60x80 ft., to be built at Franklin St. and Couch Pl., for J. H. Bradshaw at a cost of $55,000.

Monmouth, Ill.—The Monmouth Hotel Co., it is reported, has been organized for the purpose of erecting a $50,000 hotel.

Elwood, Ind.—The Masonic Lodge, it is stated, is contemplating the erection of a lodge building at a cost of $20,000.

South McAlester, Ind. Ter.—Chas. L. Thompson, Arkansas Bldg., Little Rock, it is stated, has been engaged to prepare plans for a building which is to be erected by the Ancient and Accepted Scottish Rite bodies of the Indian Territory, at a cost of about $100,000.

Des Moines, Ia.—Proudfoot & Bird, Crocker Bldg., it is stated, have prepared plans for a 5 story and basement, 60 x 132 ft. building which is to be erected at W. 8th St. and Walnut St., at a cost of $75,000, for Chase & West.

F. J. Parker and John L. Wright, of Des Moines Council, No. 115, it is reported, have been appointed to make arrangements for the erection of a $50,000 home for the United Commercial Traders' Orphans.

The Equitable Life Assoc., it is stated, will erect a 3-story brick store and apartment building at 1115 W. Grand Ave., the cost to be about $20,000.

F. M. Hubbell, it is reported, has made an offer to the Trades & Labor assembly to erect a building at 8th and Grand Aves., the cost to be about $35,000.

Baltimore, Md.—The Travelers & Merchants Assoc., it is stated, is considering the erection of a clubhouse on Hanover St. at a cost of $60,000.

The Herbert A. Weeks Co., of New York, N. Y., it is stated, has received the contract to erect the 9-story building for the Chesapeake & Potomac Telephone Co., the total cost of which is to be about $400,000.

Manistee, Mich.—Bids will be received by John O. Nessen & Co., June 7, for the erection of an Elks temple.

Detroit, Mich.—L. W. Tuller, it is reported, intends erecting an apartment hotel at Adams Ave. W. and Park St., probably 8 stories high. It is to be known as the Columbia.

Minneapolis, Minn.—Wm. C. Whitney, Loan & Trust Bldg., it is stated, are preparing plans for remodeling the Minneapolis Loan & Trust Bldg., the cost to be about $25,000.

Redwing, Minn.—The Chicago, Great Western R. R. (G. A. Goodell, Gen. Supt., St. Paul, Minn.), it is reported, intends erecting a $25,000 depot.

**Stillwater, Minn.*—The H. O. Olson Co., of Stillwater, it is reported, has received the contract to erect the bank building for the First Natl. Bank at $45,000.

Lincoln, Neb.—It is reported that the Chicago, Burlington & Quincy Ry. Co. (T. E. Calvert, Ch. Engr., Chicago, Ill.) intends rebuilding and making improvements to the passenger station here, the cost to be about $75,000.

Las Vegas, N. M.—It is reported that Saml. Lowenstein, of Los Angeles, Cal., is preparing to erect a $20,000 hotel here.

Albany, N. Y.—Washington L. Jacques, of New York City, it is stated, is the promoter of a project to erect a $1,000,000 hotel in this city.

Kingston, N. Y.—The Odd Fellows are said to be contemplating the erection of a home for the aged and indigent members of the order in eastern New York State, the cost to be about $60,000.

Buffalo, N. Y.—Walter F. Wilson, it is reported, has secured a permit to erect a block of stores at Main and Tupper Sts., at a cost of $60,000.

**Minot, N. D.*—Libby & Neilson, of Minneapolis, Minn., it is reported, have received the contract to erect a depot here for the Great Northern Ry. at a cost, including plumbing and heating, of about $30,000.

Cleveland, O.—The Avenue Apartment Co., it is stated, has been incorporated, and intends erecting an apartment hotel at Euclid and Case Aves., the cost to be about $100,000.

**Massillon, O.*—John Meinhart & Son, of Massillon, it is reported, have secured the contract to erect the B. & O. depot at a cost of $15,000.

Cincinnati, O.—See "Railroads."

Toledo, O.—It is reported that the Wayne Hotel Co. has been incorporated with a capital of $30,000 for the purpose of erecting a hotel at Jackson Ave. and St. Clair St. Earl T. Severson and W. H. Duncan are among the incorporators.

Portland, Ore.—Chas. Sweeney, of Spokane, Wash., it is reported, intends erecting an 8-story business building here estimated to cost $100,000.

Beaver Falls, Pa.—The Elks Lodge No. 348, it is stated, has purchased a site at 6th and 9th Sts. and intends erecting a building to cost $25,000.

Chattanooga, Tenn.—It is reported that a $30,000 business building is to be erected at Market St. and Montgomery Ave. by the Kirby Mitchell Co.

Knoxville, Tenn.—The Cumberland Club (J. Allen Smith, Pres.) it is stated, is contemplating the erection of a 4-story building at Cinch Ave. and Walnut St., at a cost of about $35,000.

Memphis, Tenn.—It is stated that the members of the Business Women's Club of Memphis are contemplating the erection of a club house at a cost of $50,000.

Memphis, Tenn.—It is reported that bids are about to be asked by the Illinois Central R. R. (H. U. Wallace, Ch. Engr., Chicago, Ill.), for the erection of a 3-story warehouse in this city on Main St., at an approximate cost of $150,000.

Dallas, Tex.—The Interstate Vaudeville Theatre Co., it is stated, has taken out a permit to erect a theatre at St. Paul and Commerce Sts., at a cost of $35,000.

Seattle, Wash.—The John A. Roebling's Sons Co., it is stated, has purchased a site on First Ave. S. and intend erecting a 4 story brick building to cost about $50,000.

Wm. S. Eames, of St. Louis, Mo., it is stated, is the archt. for a 10-story hotel which it is proposed erecting in this city at a probable cost of $1,000,000.

North Yakima, Wash.—P. Mullins, of Butte, Mont., it is reported, has had plans prepared for a business building which he intends erecting in this city at First St. and Yakima Ave., at a cost of $40,000.

Elkins, W. Va.—Mrs. Elkins, it is reported, intends erecting a $50,000 Y. M. C. A. building on Davis Ave.

NEW YORK CITY.

238 7th St., 6-story b. store and tenemt.; c, $50,000; o, Jos. Wolkenberg; a, Geo. F. Pelham.

176 Bway., 10-story b. and stone office bldg.; c, $500,000; o, Title Guarantee & Trust Co.,; a, Howells & Stokes.

115 4th Ave., 8-story br. and stone store and loft bldg.; c, $250,000; o, Hamilton Fish Cor.; a, Robertson & Potter.

202 W. 24th St., 9-story br. and stone club house; c, $150,000; o, The Young Men's Christian Assoc.; a, Parish & Schroeder.

55 W. 93d St., 3-story br. and stone garage; c, $70,000; o, H. A. Robbins; a, Snelling & Potter.

Amsterdam Ave. and 108th St., 6-story br. and stone store and tenemt.; c, $60,000; o, Cohen & Seplow; a, Geo. F. Pelham.

222 W. 57th St., 4-story br. and stone extension to 4-story br. and stone Society House; c, $60,000; o, American Society of Civil Engineers; a, Eidlitz & McKenzie.

894 Bway., alterations to 6-story br. and stone store and office building; c, $300,000; o, Ogden Goelet estate; a, Maynicke & Franke.

135 W. 14th St., 8-story br. and stone loft bldg.; c, $50,000; o, Styles & Cash; a, Chas. E. Birge.

523 5th Ave., 6-story br. and stone store and loft bldg.; c, $125,000; o, The 35th St. and 5th Ave. Realty Co.; a, Geo. A. Boehm.

95th St. and 2d Ave., 3 6-story br. and stone store and tenemts.; total c, $105,000; o, The Mitral Realty & Constr. Co.,; a, Horenburg & Stroub.

Park Ave. and 111th St., 6-story br. and stone store and tenemt.; c, $35,000; o, Isaac Rothfield; a, E. A. Meyers.

Lenox Ave. and 116th St., 2-story br. and stone store and loft bldg.; c, $100,000; o, Paul Mayer; a, V. Hugo Koehler.

Amsterdam Ave. and 135th St., 5 6-story br. and stone stores and tenemts.; total c, $210,000; o, Moses Crystal; a, Neville & Bagge.

Old Bway. and Manhattan St., 2 6-story br. and stone stores and tenemts.; total c, $80,000; o, Coburn & Cummings; a, Geo. F. Pelham.

Hanover Sq. and Beaver St., 10-story br. and stone extension to 9-story br. and stone office and exchange bldg.; c, $70,000; o, The New York Cotton Exchange; a, Maynicke & Franke.

CHURCHES AND DWELLINGS.

Notes Arranged Alphabetically by States.

Texarkana, Ark.—It is reported that the Presbyterian congregation is contemplating the erection of an edifice at a cost of $35,000. Address Pastor.

San Francisco, Cal.—The congregation of the Temple Emanu-El, it is stated, intends erecting a temple at Van Ness Ave. and Sutter St., at a cost of $1,000,000.

Bridgeport, Conn.—It is reported that the congregation of the St. George Episcopal Church will erect an edifice at a cost of $30,000. Rev. Geo. A. Robson, Rector.

Athens, Ga.—J. W. Golucke & Co., of Atlanta, have been selected to prepare plans for remodeling the Presbyterian Church, to cost about $15,000.

Chicago, Ill.—Oscar Beyer, 2503 N. Ashland Ave., it is stated, is preparing plans for a 3-story brick and stone building, which is to be erected at Hermitage and Sunnyside Aves., for J. H. Roseboom, 105 La Salle Ave., at a cost of $35,000.

Wm. H. Pruyn, Jr., is having plans prepared for a 3-story, 150x150 ft. brick and stone apartment house; cost estimated at $150,000.

Henry L. Newhouse, 4530 Prairie Ave., is preparing plans for an apartment to be built at 49th St. and Grand Boule., for I. A. Rubel and D. S. Stearns. It will be 3 stories high, 100x105 ft., and cost $75,000.

Thos. McCall, 1710 Ry. Exchange, is preparing plans for a 3-story apartment, 100x100 ft., to be erected at 5431 Jefferson Ave., for J. A. Carroll, at a cost of $70,000.

J. F. & J. P. Doerr, 138 Washington St., have prepared plans for a 3-story apartment, 50x200 ft., to be built at Douglas Boule. and 13th St., for C. A. Londelius & Son, at a cost of $60,000.

Horatio W. Wilson, 218 La Salle St., is preparing plans for a 3-story, 50x105-ft. apartment which Sherman T. Cooper, the builder, will erect at 46th St. and Greenwood Ave. Cost, $60,000.

Springfield, Ill.—The St. Agnes R. C. Church, it is reported, intends erecting a parsonage at a cost of $40,000. Rev. J. J. Howard, pastor.

**Baltimore, Md.*—B. F. & S. F. Bennett, 123 S. Howard St., it is reported, have received the contract to erect a 3-story apartment house at N. Charles and 28th Sts., the cost to be about $19,000.

Horton, Mich.—White & Hessey, of Lansing, Mich., it is reported, are the archts. for an edifice which is to be erected for the M. E. Church, at a cost of $50,000.

Carthage, Mo.—The members of the Presbyterian Church, according to reports, intend erecting an edifice to cost $35,000.

Kansas City, Mo.—It is reported that plans are being prepared for an edifice which is to be erected for the Central Methodist Church, at a cost of $100,000. Rev. Walker Lewis, Pastor.

Carthage, Mo.—Jos. Prather, 1101 S. Maple St., it is reported, is preparing plans for a $20,000 residence to be erected for W. H. Phelps, Jr.

Utica, N. Y.—The congregation of the Tabernacle Baptist Church, it is reported, has accepted plans prepared by Agne, Rushmer & Jennison, 31 Arcade, for erecting an addition to the church which is to cost about $20,000.

Corning, N. Y.—The members of the St. Mary's R. C. Church, it is reported, have accepted plans for a $25,000 church and convent which they intend erecting. Rev. J. N. Buster, pastor.

Valley City, N. D.—It is reported that bids are wanted until June 7 by the First Methodist Soc. (Fred. Heibel, Chmn.) for erecting a brick church.

Cincinnati, O.—Jos. G. Steinkamp & Bro., Mercantile Library Bldg., it is stated, have prepared plans for an apartment house which is to be erected by the Emery estate on site bounded by Curtis St., Alms Pl., Park Ave. and Walnut Hills, the cost to be about $150,000.

Akron, O.—It is reported that the St. Paul Episcopal Church has received $40,000 with which improvements are to be made to the edifice. Rev. N. S. Watson, Pastor.

Youngstown, O.—It is reported that the members of the Methodist Church have purchased a site at Deloson and Oak Hill Aves., and will erect an edifice to cost $20,000. Rev. W. A. Rutledge, Pastor.

Bellefontaine, O.—It is reported that the Presbyterian Church congregation is contemplating the erection of a new edifice to cost $40,000.

Canton, O.—Wm. P. Ginther, of Akron, it is stated, is preparing plans for a group of buildings which are to be erected by the Sisters of the Holy Humility of Mary, midway between Canton and Massillon. The buildings will include a mother house, academy and novitiate, and the cost it is reported will be about $150,000.

Tiffin, O.—W. R. Dowling, of Toledo, it is reported, is preparing plans for a R. C. Church, which is to be erected at a cost of $40,000.

Baker City, Ore.—It is reported that the St. Francis R. C. Church is planning to erect a $35,000 edifice. Address Pastor.

Philadelphia, Pa.—Churchman & Thomas, 532 Walnut St., it is stated, are preparing plans for an edifice which is to be erected at 15th and Porter Sts., for St. Paul's Episcopal Church, at a cost of about $30,000.

*A permit has been granted to Doyle & Doak, 1509 Sansom St., to erect a 4-story brick and stone dwelling, which is to be at 22d and Locust Sts., at a cost of $25,000.

Pittston, Pa.—The Hebrew congregation of Rodeph Sholon, it is reported, will erect a synagogue at a cost of $200,000 on 5th Ave. and will have plans prepared by Wm. P. Laird of the Univ. of Penn.

Pittsburg, Pa.—It is reported that the Trus. of the Zion Evangelical Church intend erecting a new edifice at a cost of $50,000. Address Pastor.

Chattanooga, Tenn.—The members of the Central Baptist Church, it is stated, are contemplating the erection of a new edifice at a cost of $25,000.

Memphis, Tenn.—It is stated that J. Goldsmith has taken out a permit to erect a 2-story brick and stone residence at Vance and Orleans Sts., to cost $20,000.

Fred H. Eely & Co., Randolph Bldg., it is stated, are preparing plans for a $25,000 flat, which is to be erected for Mrs. M. C. Cobb at Jefferson and 3d Sts.

J. C. Norflett, it is reported, will erect a $40,000 residence at Central and Browne Aves.

Norfolk, Va.—J. T. Bolton, it is stated, is having plans prepared for a 7-story apartment house which is to be erected on Botetourt St., at an approximate cost of $150,000.

**Janesville, Wis.*—Schneilberg Bros. and W. S. Stevens, of Beloit, it is stated, have received the contract to erect the Central Methodist Church at about $29,950.

Superior, Wis.—The congregation of the St. Francis Xavier R. C. Church, it is stated, has decided to make improvements in the edifice, the cost to be about $25,000.

NEW YORK CITY.

9 E. 68th St., 6-story br. and stone dwell.; c, $150,000; o, Mrs. Geo. T. Bliss; a, Heins & LaFarge.

311 E. 118th St., 6-story br. and stone tenmt.; c, $50,000; o, Epstein & Cohen; a, Bernstein & Berstein.

129th St. and Lenox Ave., 5 5-story br. and stone tenemts; total c, $350,000; o, Weinstein & Lurie; a, Geo. F. Pelham.

136th St. and Riverside Drive, 2 5-story br. and stone tenemts.; total c, $100,000; o, Rosalia Meli; a, Louis C. Mauer.

137th St. and Riverside Drive, 3 6-story br. and stone tenemts.; total c, $240,000; o, Transit Realty Co.; a, Moore & Landsiedel.

144th St. and 7th Ave., 2 6-story br. and stone tenemts.; total c. $70,000; o, A. Lazinsk & Co.; a, Bernstein & Bernstein.

144th St. and 8th Ave., 6-story br. and stone tenemt.; c, $60,000; o, Robt. Altman; a, Geo. F. Pelham.

153d St. and Amsterdam Ave., 5-story br. and stone tenemt.; c, $40,000; o, Gordan & Dushman; a, Lorenz F. J. Weiher.

158th St. and Amsterdam Ave., 3 5-story br. and stone tenemts.; total c, $135,000; o, Karp & Heller; a, John Hauser.

Brook Ave. and 170th St., 2 6-story br. tenemts; total c, $70,000; o, August Jacob; a, Walter H. C. Hornum.

539 E. 86th St., 6-story br. and stone tenemt; c, $60,000; o, Fred H. Nadler; a, Eugene J. Stern.

207 E. 108th St., 3-story br. and stone tenemts; total c, $120,000; o, Julius Weinstein; a, Bernstein & Bernstein.

116 E. 114th St., 6-story br. and stone tenemt.; c, $40,000; o, Osher Gordon; a, Eugene J. Stern.

317 W. 83d St., 6-story br. and stone tenemt; c, $160,000; o, Julian Isaac; a, John E. Scharsmith.

100th St. and Columbus Ave., 2 5-story br. and stone tenemts.; c, $80,000; o, Smith & Roeffler; a, Neville & Bagge.

**Items marked thus give the names of parties awarded contracts.*

Columbus Ave. and 86th St., 2 6-story br. and stone apartment houses; total c, $450,000; o, Houpt & Finney; a, Mulliken & Moeller.

139th St. and Amsterdam Ave., 3 5-story br. and stone tenemts.; total c, $150,000; o, Mishkind & Feinberg; a, Geo. F. Pelham.

142d St. and Lenox Ave., 6-story br. and stone tenemt.; c, $45,000; o, M. Psaty and M. Edelson & Co., a, Edward A. Meyers.

144th St. and Amsterdam Ave., 2 5-story br. and stone tenemts.; total c, $100,000; o, Book & Ginsberg; a, Geo. F. Pelham.

146th St. and Amsterdam Ave., 5 6-story br. and stone tenemts.; total c, $210,000; o, Weinberg & Ludzens; a, Benj. W. Levitan.

147th St. and Bway., 2 5-story br. and stone tenemts.; total c, $80,000; o, Markus Pollack; a, Neville & Bagge.

180th St. and Amsterdam Ave., 2 5-story br. and stone tenemts.; total c, $80,000; o, Wallach, Reisler & Co.; a, Moore & Landsiedel.

139th St. and St. Ann's Ave.; 3 5-story br. tenemts.; total c, $90,000; o, Michael F. Cusack; a, Wm. H. Birkmire.

Grant Ave. and 163d St., 5 3-story br. dwells.; total c, $50,000; o, Wm. E. Diller; a, G. A. Schellenger.

Jackson Ave. and 160th St., 2 5-story br. tenemts; total c, $76,000; o, Annie C. Levitt; a, Goldner & Goldberg.

SCHOOLS.

Notes Arranged Alphabetically by States.

Marianna, Ark.—Bids will be received June 10 by the School Bd., Special Dist. No. 1 (H. B. Derrick, Secy.) for erecting a 2-story 8-room brick school; H. H. Hohenschild, Archt., Rollo, Mo.

Hot Springs, Ark.—Plans are being prepared for two 2-story brick schools which are to be erected at an estimated cost of $15,000 each. One is to be on Ramble St. and the other on School St.

Red Bluff, Cal.—The citizens are reported to have voted in favor of issuing $32,000 bonds for erecting a union high school.

Berkeley, Cal.—It is reported that school bonds, amounting to $150,000 have been sold.

El Monte, Cal.—The School Bd. has accepted the plans of A. C. Smith, of Los Angeles, for the high school building which is to be erected at a cost of $12,000, and it is stated that bids for its erection will soon be asked.

**New Haven, Conn.*—G. T. Hewlett, Secy. Bd. Educ., writes that contracts for erecting an 18-room school (bids opened Apr. 19) has been awarded as follows: Carpenter and joiner's work, David H. Clark Co.; mason work, Jas. H. Hogan; plumbing and gas fitting, Jas. J. Grady, and ventilating and heating, John B. Beegan. Contractors all of New Haven; total cost, about $58,000.

Hartford, Conn.—A bill has passed the House appropriating $40,000 for repairs to buildings, erection of minor buildings, etc., at the Connecticut Agricultural College.

**Washington Barracks, D. C.*—The contract for furnishing 2,000,000 common brick for the use in the construction of building at the Army War College at Washington Barracks (bids opened May 6) has, it is reported, been awarded to the Washington Brick & Terra Cotta Co., 3d, Cor. O., S. W., Sts., at $8.42 per thousand; total, $16,840.

**Boise, Idaho.*—Thos. A. Harris, it is reported, has received the contract to erect a normal school at a cost of about $27,000.

**Champaign, Ill.*—F. H. Jahr, it is stated, has received the contract to erect a school at Healey and 4th Sts., at $15,520.

**Evansville, Ind.*—Archt. F. J. Schlotter, of Evansville, writes that the contract for rebuilding Campbell St. School has been awarded to Chris Kanzler & Son, 1104 E. Illinois St., for $42,750.

Indianapolis, Ind.—It is reported that bids will be received June 13 by the School Bd. (John E. Cleland, Bus. Dir.) for erecting a boiler house and remodeling and repairing school 11; erecting an addition to school 18; also for furnishing materials and installing ventilating and heating and plumbing in school 11.

Ft. Wayne, Ind.—It is reported that bids will be received until June 12 by the School Bd. (Alex Hamilton, Secy.) for erecting a 14-room school. Bradley & Allen, Archts., Ft. Wayne.

Stratford, Ia.—It is stated that the citizens have voted in favor of issuing bonds to erect a school.

Des Moines, Ia.—Bids will be received until June 26 by A. J. Cork, Secy. Bd. Educ. for the Grant Park Dist. of Des Moines, for erecting an addition to Grant Park School. W. R. Parson & Sons Co., Archts., Des Moines.

Caney, Kan.—It is reported that the citizens have authorized the issue of $25,000 school bonds.

Boston, Mass.—Bids will be received until June 7 by the Schoolhouse Comrs. (R. Clipston Sturgis, Chmn.) for alterations in ventilating and heating systems, electric work, etc., in Lewis School, Dale and Sherman Sts., Roxbury; French & Hubbard, Engrs., Albany Bldg.

Amherst, Mass.—Bids will be received June 10 by the Bldg. Com. (Jas. Draper, Chmn., 287 Plantation St., Worcester), for erecting the horticultural building of the Mass. Agricultural College at Amherst; probable cost, including equipment, $39,950.

Woburn, Mass.—The School Bd. has approved the plans submitted by Robt. A. Cook, of Milford, for the $100,000 brick school which is to be erected on Montvale Ave.

Wyandotte, Mich.—Bids will be received June 9 by the Bd. Educ. (Clyde E. Baxter, Secy.) for furnishing the heating apparatus for the new school; Leyen & Schilling, Archts., Peninsula Bank Bldg., Detroit.

*Burk, Smith & Nelson, of Muskegon, Mich., it is stated, have received the contract to erect the school at about $41,000.

Ann Arbor, Mich.—Bids will be received until June 12 by the Bd. Educ. (Grove J. Ray, Secy.) for erecting a High School and a public library; Malcomson & Higginbotham, Archts., Detroit.

**Bay City, Mich.*—J. Meagher and H. J. Beard, it is reported, have received the contract to erect a $20,000 school in St. James parish.

**Mankato, Minn.*—The Bd. of Educ., it is reported, has awarded the contract for a ventilating and heating plant in the W. Mankato School to the Pond-Hasey Co., of Minneapolis, Minn., at $2,069.

**St. Cloud, Minn.*—The State Bd. of Control, it is reported, has awarded the contract for rebuilding the Lawrence Hall for girls at the St. Cloud Normal School to O'Neill & Sons, of Fairbault. Appropriation, $50,000.

Minneapolis, Minn.—School bonds amounting to $200,000 have been sold.

Winona, Minn.—The Normal School Bd. will receive bids June 7 for placing a new roof on main building of the normal school here, and the installation of a ventilating and heating plant; estimated cost of work $35,000.

Clinton, Miss.—The members of the family of the late Capt. Z. D. Jennings, of Water Valley, Miss., it is reported, intend erecting a $20,000 building at Mississippi College as a memorial to their father. It is reported that $25,000 has been donated toward a science building at the college on condition that $75,000 is raised for other buildings.

Poplar, Mont.—Bids will be received until June 26 by C. B. Lohmiller, Supt., Indian School, Poplar, for furnishing materials and remodeling and improving buildings at said school.

Newark, N. J.—The following are reported to be the lowest bids received May 23 by the Bd. Educ. for school improvements: (*a*) mason work, (*b*) carpenter work, (*c*) iron work; (*d*) roofing and metal work; (*e*) plumbing; (*f*) steam heating work; (*g*) electrical work; (*h*) air-moving apparatus; (*i*) total:

Belmont Ave. school, *a* Oscar Staeger & Sons, $63,053; *b* Wm. G. Sharwell & Co., $20,269; *c* Hedden Iron Construction Co., $7,208; *d* Baier & Conrad, $6,590; *e* Jaehnig & Peoples, $6,693; *f* Shay & Robinson, $7,849; *g* Wm. Browe's Son Co., $3,491; *h* Electrical Motor & Equipment Co., $1,475; *i* $118,460.

Elliot St. school, *a* John Guerin, $32,770; *b* Wm. G. Sharwell & Co., $11,879; *c* Hedden Iron Constr. Co., $5,246; *e* Jaehnig & Peoples, $3,087; *d* Ding & Teuscher, $4,711; *f* Shay & Robinson, $5,299; *g* Wm. Browe's Son Co., $1,589; *h* Electrical Motor & Equipment Co., $840; *i* $66,365.

14th Ave. school, *a* I. B. Guerin, $43,521; *b* Wm. G. Sharwell & Co., $12,879; *c* Hedden Iron Constr. Co., $6,534; *e* Jaehnig & Peoples, $4,747; *d* Baier & Conrad, $3,180; *f* Shay & Robinson, $5,449; *g* Wm. Browe's Son Co., $1,576; *h* Electrical Motor & Equipment Co., $830; *i* $79,621.

According to later local press reports, contracts have been awarded on the 14th Ave. and Elliot St. schools as given above.

The Bd. of Educ. has approved plans prepared by Chas. P. Baldwin, 45 Clinton St., for the Avon Ave. School, and, it is stated, that bids for its erection will soon be asked.

Hammonton, N. J.—The School Bd., it is stated, has decided to erect a school at a cost of $17,000.

New York, N. Y.—Plans have been filed for a 5-story brick and stone school which is to be erected by the City of New York at Rivington and Pitt Sts. at a cost of $115,000. Archt., C. B. J. Snyder, 500 Park Ave.

Bids will be received until June 12 by C. B. J. Snyder, Supt. of School Bldgs., for sanitary repairs in schools Nos. 6, 18, 32, 43, 51, 52, 53, 54, 55, 57, 59, 74, 77, 96, 113 and 171, Boro. of Manhattan; also on June 19 for alterations, repairs, etc., in schools Nos. 9, 10, 17, 28, 32, 43, 51, 54, 58, 67, 84, 87, 93, 94, 127, 141, 157, 165, 166, 170, 179 and 184, Boro. Manhattan, and in schools Nos. 1, 2, 3, 4, 9, 10, 11, 18, 20, 27, 28, 29, 30, 31, 35, 38 and Morris High School, all in the Boro. of Bronx.

*The following are the bids opened May 29 by C. B. J. Snyder, Supt. School Bldgs., for general construction, etc., of the temporary building No. 7, Borough of Manhattan (under Williamsburg Bridge approach): Edmund D. Broderick, 115 E. 90th St., $46,293 (awarded contract); Wm. Werner, $47,770; Jos. Ohlhausen, $47,788; Lincoln & Ranney, $48,400; Ralph J. F. Gerstle Co., $52,864, and Laurence J. Rice, $48,761.

**Brooklyn, N. Y.*—The following are the bids opened May 29 by C. B. J. Snyder, Supt. School Bldgs., N. Y. City, for ventilating and heating (*a*) School 147, (*b*) School 110, both in Brooklyn Boro.: E. Rutzler Co., 178 Centre St., N. Y. City, *a* $49,915, *b* $23,865 (awarded contract), Walker & Chambers, *a* $52,437, *b* $25,380, Blake & Williams, *a* $50,932; Dowdeswell Bros., 399 Bridge St., *a* $49,267 (awarded contract), *b* $24,474; Rossman & Bracken Co., *a* $49,600, *b* $25,800; Wm. N. Tobin, *a* $51,000, *b* $24,994; Jas. Curran Mfg. Co., *a* $51,000; United Htg. Co., *a* $53,747, *b* $24,621; Frank Dobson, *b* $24,000.

*The following are the bids opened same time and place for general construction of school 92, Brooklyn Boro.: Chas. H. Peckworth, 415 Hudson St., N. Y. City, $192,365 (awarded contract); Geo. Hildebrand, $193,700, and Geo. F. Driscoll, $194,787.

The following are the bids opened same time and place for sanitary work and gas fitting of additions to and alterations in school 103, Brooklyn Boro.: Jas. Harley & Co., 288 Flatbush Ave., $12,551 (awarded contract), Wm. C. Ormond, $12,980; Jas. Fay's Son, $13,183, and Frank J. Fee, $17,793.

Long Island City, L. I., N. Y.—Bids will be received until June 12 by C. B. J. Snyder, Supt. of School Bldgs., N. Y. City, for sanitary work and gas fitting in school No. 4, improving the sanitary conditions in schools Nos. 5, 7, 11, 14, 31, 34, 39, 59, 72 and 80, Boro. of Queens, and for alterations, etc., in school 26, Flushing.

**New Brighton, S. I., N. Y.*—The Murray Constr. Co. has secured the contract for general construction, etc., of School 7, Boro. of Richmond (bids opened May 29) for $16,440.

Troy, N. Y.—It is stated that plans will be received by the Comr. Pub. Wks. until June 7 for stairways and extensions of the Bway. approach at the Rensselaer Polytechnic Inst., the cost not to exceed $40,000.

Watertown, N. Y.—Press reports state that bids will be received until June 12 by the School Bd. for installing a ventilating and heating plant in Mead St. School, consisting of a direct and indirect fan system with 2 boilers, and to provide 30 cu. ft. of fresh air per minute, appropriation $3,500.

Bottineau, N. D.—Jos. B. De Remer, of Grand Forks, N. D., it is reported, has completed plans for a $30,000 building to be erected by the School of Forestry. Address Trustees.

Cleveland, O.—Bids will be received June 7 by the Bd. Educ. (Geo. E. Myers, Clk.) for $300,000 school improvement bonds.

Bedford, O.—Bids will be received June 24 by the Bd. Educ. (Ella F. Senter, Clk.) for furnishing materials and erecting an 8-room brick and stone school, including heating and electrical work; H. O. Wurmser and W. L. Kramer, both of Lorain, are the Associate Archts.

Cincinnati, O.—It is stated that bids will be received until June 12 by the Bd. Educ. for erecting a school on White St. Jacob E. Cormany, Chmn. Com.

Youngstown, O.—The Bd. of Educ. has selected Owsley & Bourcherle, Wick Bank Bldg., as the Archts. for the 10-room school which is to be erected on Myrtle Ave., at a cost, including heating, etc., of about $39,000; also R. F. Thompson, Diamond Blk., as the Archt. for a 2-room addition to McGuffey St. school, and a 4-room building at Lansingville.

Akron, O.—The Bd. of Educ. has accepted the plans of Bunts & Bliss, Hamilton Blk., for the school to be erected on North Hill, the building to contain 12 rooms and to cost about $47,000.

Lorain, O.—School bonds amounting to $47,000 have been sold.

Stillwater, Okla. Ter.—Bids will be received June 6 by the Bd. Regents, Oklahoma Agricultural and Mechanical College (Frank J. Wikoff, Pres.) for erecting a shop.

Spartanburg, S. C.—The School Trus., it is stated, have purchased a site on Church St. on which to erect a school at a cost of $20,000.

Wakonda, S. D.—It is reported that bids are wanted until June 12 for a 2-story brick school; Nettott & Bonnan, Archts, Independence, Ia.

Chattanooga, Tenn.—See "Sewerage and Sewage Disposal."

Nashville, Tenn.—It is reported that plans are soon to be received for 2 buildings which are to be erected at the Vanderbilt Univ., one to be the administration building and to cost about $125,000, and the other a chemical laboratory and to cost $100,000.

Paris, Tex.—The School Bd. has accepted plans for a high school which it is proposed erecting at a cost of $40,000.

Green Bay, Wis.—The Bd. of Educ., it is stated, contemplates erecting a central high school at a cost of $100,000 in place of the 2 high schools now in use.

**Dodgeville, Wis.*—The contract for erecting a school (bids opened May 23) has been awarded to Chippewa Falls Constr. Co., of Chippewa Falls, for $17,966; also for heating same, to Lewis & Kitchen, of Chicago, Ill.

STREET CLEANING AND GARBAGE DISPOSAL.

Notes Arranged Alphabetically by States.

**Los Angeles, Cal.*—The Decarie Mfg. Co., of Minneapolis, Minn., is reported to have secured the contract for a garbage incinerating plant for $70,864.

**Sacramento, Cal.*—The Bd. of Trus. on May 22 awarded the contract for the erection of a Meldrum garbage destructor to the P. F. Dundon Iron Wks., of San Francisco, for $12,628.

**Washington, D. C.*—Local press reports state that the Washington Fertilizer Co., of Washington, D. C., will secure the contract for collecting and disposing of garbage in the District of Columbia for the next 5 yrs. at $78,400 per yr.

Marion, Ind.—Chas. S. Bash, of Ft. Wayne, is reported interested in the construction of a garbage crematory, to cost about $6,500.

Atlantic City, N. J.—The Finance Bd. is stated to have recommended that the Sanitary Com. prepare specifications at once and that bids for removing and destroying the city's garbage during the fiscal year beginning in September be procured so that the cost of the same may be provided for when the appropriation bill is drafted in the fall.

New York, N. Y.—Bids will be received June 8 by the Comr. St. Cleaning (J. McG. Woodbury, Comr.) for furnishing and delivering materials for completing the rubbish incinerator at Delancey Slip; including structural steel, facing and common bricks, cement, broken stone, etc.

Philadelphia, Pa.—The call for bids for cleaning the streets, etc., which were to have been opened June 1 has been withdrawn. The contract for next year, which will include both the cleaning of streets and the gathering of ashes, will cost over $1,000,000. Saml. Sutcliff, Ch. of Bureau of St. Cleaning. A. Lincoln Acker, Dir. Dept. Pub. Wks.

Ottawa, Ont.—N. J. Ker, City Engr., writes that bids will be received in about a month for the construction of a garbage plant of 50 tons capacity, to cost about $20,000.

NEW INDUSTRIAL PLANTS.

See also Business Buildings.

The Falls City Brewing Co., Louisville, Ky., will be ready to let contracts for a new brewery in about four months. Ben. H. Schrader, 1000 W. Walnut St., Secy.

G. W. Lazear, New Martinsville, W. Va., has not yet made any arrangements for rebuilding his lumber mill at Paden City, W. Va., which was recently burned. It may, however, be rebuilt later.

M. S. Levy & Sons, Lombard and Paca Sts., Baltimore, Md., propose erecting a 5-story, 60x87-ft. addition to their straw-hat factory. An electric power plant of 175 k.w. capacity will be installed.

The Morowebb Cotton Mill Co., Dallas, N. C., writes that it will doubtless build an addition to its plant this summer.

T. R. Borden, 214 Fannin St., Houston, Tex., contemplates erecting a plant in the near future for manufacturing mortar to be used in the erection of brick and stone buildings, and desires to correspond with manufacturers of machinery for same.

F. E. Myers & Bro., Ashland, O., expect to erect a 200x70-ft. addition to their foundry and a 3-story 75x50-ft. warehouse for storing castings. They do not expect to install any additional machinery except an elevator and possibly a motor for operating same.

**Items marked thus give the names of parties awarded contracts.*

Chas. T. Kornbrodt, 408 W. 6th St., Kansas City, Mo., manufacturer of cornices and skylights, has bought a site for a plant, but has not yet decided the size of the building nor when it is to be erected.

The Graff Furnace Co., 208 Water So., New York, contemplates making a small addition to its foundry at Dickson City, Pa., which will not involve the installation of any additional power plant.

C. E. Ward, Eaton Ave. and Morrison St., St. Paul, Minn., whose box factory was recently burned, will erect a 64x120-ft. building. The power will be 80 h.p. electric .

Wm. Crilly, Chicago, Ill., has been awarded contract for a 4-story, 58x98-ft. malthouse for the American Malting Co., in Kensington, according to local newspaper reports.

The B. A. James Mfg. Co., Clarksville, Tenn., is erecting a 3-story, 105x44-ft. building, to be used as a skirt and underwear factory. An electric power plant of 35 h.p. capacity will be installed.

The Vulcan Foundry Co., Hamilton, O., will this summer erect a new foundry and install new equipment.

B. F. Avery & Sons, Louisville, Ky., expect to build new works within a year, but have not yet decided on plans.

The Atlanta Spring Bed Co., 80-94 Means St., Atlanta, Ga., is erecting a 2-story, 100x200-ft. building. The company will manufacture a full line of iron and brass beds and will be in the market for the necessary supplies.

The Vulcan Mine Car Co., Windber, Pa., expects to build a plant in Vulcan, Pa., the coming summer or early in the fall, but details regarding the plant are as yet unavailable.

The Stoughton Mills, West Stoughton, Mass., expect to put in a direct-connected dynamo and engine to run their card room by motor.

The Champlain Silk Mills, Whitehall, N. Y., are erecting a 6-story, 72x64-ft. brick and concrete addition and will install in it two 125-h.p. water wheels and electric generators and motors of the same capacity.

C. H. Brooks, Waterford, Conn., is erecting a 4-story and basement, 36x72-ft. grist mill and elevator, to be run by water power. The plant may be equipped with a 40-h.p. steam power plant.

The Du Mont Engineering Co., 702 Observatory Bldg., Des Moines, Ia., will erect a 66x125-ft. building at Colfax, Ia., and will install a 50-ton plate ice machine, using compound engines, condensing water-tube boilers, etc.

The Atchison Saddlery Co., 823-830 Main St., Atchison, Kan., has bought a 3-story and basement, 45x150-ft. building, which will be equipped with a steam heating system and a sprinkling system. The company will erect a 20x80-ft. collar factory, to be equipped with a steam heating system, and a 25x60-ft. boiler house, to be equipped with a 30-h.p. engine and boiler.

The Hendey Machine Co., Torrington, Conn., manufacturer of machine tools, has let contract for a 200x11-ft. building of brick and steel construction with cement roofs and floors. An electric crane will be installed, but no additional power plant will be required.

The Henry-Bonnard Bronze Co., 430-444 West 16th St., New York, will erect a plant at Mt. Vernon, N. Y., which will include two 150x75-ft. main buildings, a power house about 50x75 ft., to contain 150-h.p. power plant, and two small buildings. Modern tools will be installed.

The Estate of L. B. Harrison, First National Bank Bldg., Cincinnati, O., will erect a building to have 12 stories and two basements, each floor to contain over 16,500 sq. ft. floor space. Plans for power plant have not yet been prepared, except for heating boilers. It is expected that a contract will be made with the public service company for power and light, which will avoid installing a 300-k.w. power plant.

MISCELLANEOUS.

Notes Arranged Alphabetically by States.

**Varner, Ark.*—Geo. de Benghem, of Memphis, Ch. Engr., Linwood and Auburn Levee Bd., writes that M. J. Roach & Co., of Memphis, Tenn., has secured the contract for enlarging levee in Lincoln County (bids opened May 24) at 14 cts. per cu. yd., for about 600,000 cu. yds.

Wilmington, Del.—Bids are wanted June 26 for dredging harbor at Wilmington, as advertised in The Engineering Record.

Washington, D. C.—See "Power Plants, Gas and Electricity."

Washington, D. C.—Bids will be received until June 20 at the Bureau Supplies and Accounts, Navy Dept., Washington, for furnishing at the navy yards, Portsmouth, N. H., Boston, Mass., New York, N. Y., and Norfolk, Va., a quantity of machine tools, etc., as follows: Rotary converters; steam piping system; foundry crane; pump; drills; motor drive outfits; pipe threading machine; milling, plug, cutting-off and sanding machines, etc.; H. T. B. Harris, Paymaster-Gen., U. S. N.

Pensacola, Fla.—Bids will be received June 13 at the Bureau Supplies and Accounts, Navy Dept., Washington, D. C., for furnishing at the Navy Yard, Pensacola, a quantity of supplies, as follows: Pipe fittings; ingot copper; bar iron; sheet and slab zinc, etc. H. T. B. Harris, Paymaster-Gen., U. S. N.

Savannah, Ga.—The following are the bids opened May 19 by Lieut.-Col. J. B. Quinn, Corps Engrs., U. S. A., for repairing and raising portions of south jetty and raising extreme outer end of north jetty at Cumberland Sound, Ga., 31,000 tons; (a) price per ton; (b) total: Simons-Mayrant Co., Charleston, (a) $2.93, (b) $90,830; Roderick G. Ross, Jacksonville, Fla., (a) $2.77, (b) $85,870 (recommended for acceptance).

Bids are wanted June 30 for dredging in harbor at Savannah, as advertised in The Engineering Record.

Savannah, Ga.—Bids will be received June 14 by Jas. Knox Taylor, Superv. Archt., Washington, D. C., for installing an electric passenger elevator and an electric dumb waiter in the U. S. Marine Hospital here.

**Rock Island, Ill.*—Maj. C. S. Riche, Corps Engrs., U. S. A., writes that the following bids have been recommended for acceptance in connection with the construction and repair of dams and shore protection on Upper Mississippi River (bids opened May 20) (*a*) price per cu. yd. for rock; (*b*) fascines per cu. yd.; (*c*) average per cu. yd.: A. J. Whitney, of Rock Island, bet. Savanna and Le Claire, *a* $1.32; *b* 49 cts.; *c* 82.2 cts.; total cu. yds., 38,029.4. Albert Kirchner, Fountain City, Wis., bet. Rock Island and Burlington, *a* $1.39; *b* 51 cts.; *c* 86.2 cts.; total cu. yds., 37,123. The same contractor for that portion bet. Burlington and Hannibal, *a* $1.44; *b* 51 cts.; *c* 88.2 cts.; total, 47,619 cu. yds. Marshall Rust, Pilot Grove, Mo., for that portion bet. Clarkville and Cap au Gris, *a* $1.37; *b* 53 cts.; *c* 86.6 cts.; 36,951.5 cu. yds.

Chicago, Ill.—Bids will be received until July 1 by the Lincoln Park Comrs. (Wm .W. Tracy, Pres.) for building a sea-going power dredge for the Comrs.

**Auburn, Ind.*—H. D. Boozer, Co. Aud., writes that J. W. Pearl, of Berton Harbor, has secured the contract for constructing Cedar Creek Drain, No. 793, (bids opened May 11), for 6¼ cts. per cu. yd.

York, Me.—Bids will be received by Maj. W. M. Black, Corps Engrs., U. S. A., Portland, June 30, for dredging in York Harbor, Me., as advertised in The Engineering Record.

Portland, Me.—The following are the bids opened May 29 by Maj. W. M. Black, Corps Engrs., U. S. A., for dredging (*a*) Damariscotta River, 5,555 cu. yds.; (*b*) New Harbor, 39,375 cu. yds. (price given per cu. yd.): Eastern Dredging Co., 247 Atlantic Ave., Boston, Mass., *a* 89 cts., *b* 26¾ cts.; John H. Letteney, 50 Congress St., Boston, Mass., *a* 97 cts., *b* 27 cts. No bids were received for dredging in Bagaduce River.

Boston, Mass.—Bids are wanted June 27 for dredging in Mystic and Malden Rivers, Mass., as advertised in The Engineering Record.

Boston, Mass.—Bids will be received June 26 by Col. W. S. Stanton, Corps Engrs., U. S. A., for dredging in Mystic River, Mass.

Cambridge, Mass.—A bill has been passed in the Legislature providing for the construction of a 4-track subway from Harvard Sq., Cambridge, to Scollay Sq., Boston, about 3 miles in length.

Ft. Andrews, Peddocks' Island, Mass.—Bids will be received until June 19 by Maj. John E. Baxter, Q. M., U. S. A., Boston, for furnishing materials and constructing a section of block concrete sea wall, reenforced with steel rods, at Ft. Andrews.

Winthrop, Mass.—Bids will be received until June 19 by Maj. John E. Baxter, Q. M., Boston, for furnishing material and repairing timber wharf, wharf approaches and constructing a wharf drop at Winthrop.

Fall River, Mass.—Bids will be received until June 10 by Frank A. Thurston, Supt. of Streets, for the purchase and removal of a No. 5 gate crusher with stationary engine, revolving screen, elevator and bins now located off 14th St., between Bedford and Pleasant Sts., and belonging to the Street Dept. of the city.

Revere, Mass.—The Senate is reported to have passed a bill authorizing the State Harbor and Land Comrs. at Boston to construct a stone breakwater off the town of Revere.

Duluth, Minn.—Bids will be received by Maj. Chas. L. Potter, Corps Engrs., U. S. A., Duluth, June 27, for dredging about 117,000 yds. in Portage Lake ship canals, Keweenaw Point, Mich.; also June 26 for pile dike and rip rap at Grand Marais, Mich., both advertised in The Engineering Record.

St. Paul, Minn.—The State Drainage Bd. is reported to have authorized an expenditure of $30,000 for drainage ditches in northern Minnesota during the ensuing year.

Bids will be received until June 15 by the Secy. of State for constructing the following ditches: Kinberly, Aitkin Co., 20,000 cu. yds.; Wing River, Otter Tail Co., 9,000 cu. yds., and Roseau River improvement, Roseau Co., 104,000 cu. yds. Geo. A. Ralph, Engr., Crookston.

**Roseau, Minn.*—John Kohler, of Frazee, has secured the contract for constructing a county ditch 8 miles in length (bids opened May 22) at 12¾ cts. per cu. yd. for 91,516 cu. yds.

Vicksburg, Miss.—Bids are wanted June 20 for furnishing a quantity of stone, poles, wire, wire strand, etc., as advertised in The Engineering Record.

Papillion, Neb.—It is stated that bids will be received until June 8 for constructing a drainage ditch 32,365 ft. long and requiring 52,807 cu. yds. excav. P. D. McCormick, Co. Clk.

Newark, N. J.—The following are reported to be the bids opened on May 23 by the Essex County Park Comn. for the improvement of Park Ave. at the new bridge, comprising the removal of the present roadway, completing the approaches to the bridge and connecting the roads and waterways of the lower and middle sections of Branch Brook Park beneath the structure: Harrison Constr. Co., Newark, $33,718! T. A. O'Connor, Newark, $32,875; Pasquale Cestone, Montclair, $32,254; F. M. Stillman & Co., Jersey City, $31,305; Essex County Constr. Co., $30,850, and Robt. W. Smith, of New York, $36,382.

New York, N. Y.—The following are the bids opened May 26 by the Dept. Docks and Ferries for 1,000 piles (price given per pile), bidders all of New York City: Naughton & Co., $11.85; Stanley H. Miner, $14; Chas. K. Nichols, $12.90; Empire Timber Co., $14.75; J. H. Burton & Co., 18 Bway, $11.47 (awarded contract), and Bernard Rolf, $16.

Bids will be received until June 9 by the Dept. Docks and Ferries (Maurice Featherson, Comr.) for furnishing materials and constructing a pier near foot of Cuyler's Alley, East River, to be known as Pier 8; bids will also be received same date for constructing a pier at the ft. of Old Slip, to be known as Pier 10, East River.

The following are the bids opened on May 29 by the Dept. Docks and Ferries for furnishing material and repairing, altering and extending present ferry structures at foot of Whitehall St., East River, and for dredging thereat: Snare & Triest Co., 143 Liberty St., $130,747 (awarded contract); G. B. Spearin, 17 Battery Pl., $180,058; Wm. E. Rogers, 44 Broadway, 182,045, and Bernard Rolf, 39 Cortlandt St., $153,733.

Mayor McClellan is stated to have approved a resolution appropriating $75,000 for cleaning Gowanus Canal, and work will begin at once. The plans call for a 6,000 ft. tunnel, 12 ft. wide, with a large pumping station at the head.

Brooklyn, N. Y.—Bids will be received June 8 by Nicholas J. Hayes, Fire Comr., New York City, for furnishing and delivering plumbing supplies in the Boros of Brooklyn and Queens.

**New Rochelle, N. Y.*—The Seely-Taylor Co. is stated to have secured the contract for constructing a concrete and stone dock at Hudson Park; bids opened by City Council May 16.

Buffalo, N. Y.—Lieut.-Col H. M. Adams, Corps Engrs., U. S. A., writes that the following are the bids opened May 26 for dredging in Buffalo River entrance channel, 50,000 cu. yds., scow meas. (price given per cu. yd.: Lake Erie Dredging Co., Buffalo, 33¼ cts.; Wm. P. Donnelly, Buffalo, 31 cts.; Buffalo Dredging Co., Buffalo, 29 cts. (recommended for award).

Buffalo, N. Y.—The following are the bids opened May 29 by H. M. Adams, Corps Engrs., U. S. A., for construction of stone superstructure and sea slope for stone rip rap on south harbor section of Buffalo breakwater: (*a*) Andrew P. Lawton, Painesville, O., $97,392, (*b*) Federal Contr. Co., New York City, $112,125.

	a	*b*
360 lin. ft. tearing out old superstructure.	$15.00	$20.00
18,800 tons coping stone	3.34	3.75
500 tons rubble stone	1.40	1.35
15,000 tons large rip rap stone	1.90	2.25

Lorain, O.—The following are the bids opened on May 19 by Lieut. Col. Dan. C. Kingman, Corps Engrs. U. S. A., Cleveland, for reconstructing and repairing parts of the West Pier at Lorain Harbor: (*a*) L. P. & J. A. Smith Co., Cleveland; (*b*) Patk. Keohane, Fayetteville, N. Y.

	a	*b*
645 lin. ft. preparing old superstructure	$10.00	15.00
900 cu. yds. concrete blocks	14.00	10.50
2,200 cu. yds. concrete in mass	10.00	7.50
60 M. ft. hardwood sheathing	175.00	135.00
12 M. ft. oak timber	105.00	100.00
25,000 lbs. lag screws and washers	.07	.06
2,500 lbs. screw bolts and washers	.07	.08
7,500 lbs. sleeve bolts and washers	.07	.08
4,000 lbs. tie rods and washers	.07	.10
1,300 tons small riprap stone	1.30	1.13
100 tons broken stone	1.75	1.60
Total	$57,405	$49,254

Cleveland, O.—Bids will be received until June 20 by Lieut. Col. Dan. C. Kingman, Corps Engrs., U. S. A., Cleveland, for reconstructing and repairing parts of the west pier at Lorain Harbor, O.

Portland, Ore.—Bids will be received until June 22 by Maj. W. C. Langfitt, Corps Engrs., U. S. A., for mattress, rock and pile work in connection with extension of jetty at mouth of Coquille River, Ore.

Pittsburg, Pa.—The Ohio River & Lake Erie Ship Canal Co. is reported incorporated, with a capital of $600,000, by Pittsburg capitalists, including John E. Shaw, Geo. A. Kelly, Jr., and Wm. I. Jones, to construct the Lake Erie and Ohio River Ship Canal. Emil Swenson, Frick Bldg., Pittsburg, is reported to be one of the engineers who will have charge of the proposed work.

Buffalo, N. Y.—The following are the bids opened May 20 by Lieut. Col. H. M. Adams, Corps Engrs., U. S. A., for breakwater extension at Cape Vincent: (*a*) Buffalo Dredging Co., Buffalo; (*b*) John Henrick, Oswego; (*c*) Lake Erie Dredging Co., Buffalo.

	a	*b*	*c*
2,200 cu. yds. excav. for foundation	$1.50	$1.00	$1.59
3,400 cu. yds. stone for foundation	2.00	1.35	2.25
3,970 tons stone for foundation	1.75	1.20	2.00
200 lin. ft. timber cribs complete	88.00	70.60	91.00
454 cu. yds. concrete blocks	1.90	1.40	2.10
266 cu. yds. concrete blocks	13.00	12.00	13.50
440 cu. yds. concrete in place	11.00	8.00	11.75
8 manhole covers	5.00	5.00	5.00
6 mooring posts	50.00	25.00	38.00
400 lin. ft. white oak feeder on superstructure	1.00	.90	.90
Total	$37,600	$28,808	$39,690

Pittsburg, Pa.—The following are the bids opened May 27 by Maj. Wm. L. Sibert, Corps Engrs., U. S. A., for building a lock with 2 chambers, 2 guide walls, and a guard wall near Elizabeth, Pa., Monongahela River: (*a*) Ohio River Contract Co., Evansville, Ind.; (*b*) Baker Contract Co., Inc., Pittsburg; (*c*) Federal Contr. Co., New York, N. Y.; (*d*) Fogle & Francy, Allegheny; (*e*) Thos. McNally Co., Pittsburg; (*f*) The Dravo Contr. Co., Pittsburg.

	a	*b*	*c*	*d*	*e*	*f*
40,000 cu. yds. earth excav.	$0.80	$0.60	$0.75	$0.65	$0.55	$0.50
11,000 cu. yds. rock excav.	2.50	2.50	1.75	1.50	3.00	2.00
25,000 cu. yds. back fill	.40	.50	.55	.60	.50	.30
38,000 cu. yds. concrete	5.75	6.00	5.50	6.35	7.75	5.25
1,080 cu. yds. reinforced concrete	7.50	12.50	11.00	8.50	9.00	7.00
Total	$296,100	$305,500	$283,880	$307,980	$371,720	$256,560

**Items marked thus give the names of parties awarded contracts.*

Panama.—Bids will be received until June 12 by the Isthmian Canal Comn., at Washington, D. C. (Maj. H. J. Gallagher, U. S. A., Purchasing Agt.), for furnishing leather belting and belt hooks.

**Providence, R. I.*—Lieut.-Col. J. H. Willard, Corps Engrs., U. S. A., Newport, writes that the contract for dredging anchorage area in Providence Harbor (bids opened May 15) has been awarded to Columbia Dredging Co., 64 Broad St., New York, N. Y., for a total of $400,000.

Block Island, R. I.—The following are the bids opened on May 23 by Lieut.-Col. J. H. Willard, Corps Engrs., U. S. A., Newport, for dredging in harbor at Block Island (price given per cu. yd.), amount available for work, $30,000: J. S. Packard Dredging Co., Providence, 24 cts.; Morris & Cumings Dredging Co., 17 State St., New York, N. Y., 32 cts.; Chas. M. Cole, Fall River, Mass., 27 cents., and John P. Randerson, Albany, N. Y., 35 cts.

Bids were opened same time and place for repairing breakwater at Block Island (price given per ton of 2,000 lbs. stone in place), amount to be expended, $18,000: E. S. Belden & Sons, 217 Laurel St., Hartford, Conn., $2.13, and Federal Contr. Co., 5 Nassau St., New York, N. Y., $2.25.

North Platte, Neb.—Bids were opened at the office of the U. S. Reclamation Service, Chamber of Commerce Bldg., May 16 for the construction of about 45 miles of main canal, for the irrigation of lands in North Platte Valley, Wyo. and Neb.: The work is divided in 10 sections; namely, from 1 to 10: Monarch & Porter, Des Moines, Ia., bid only on Sec. 3, $79,600; R. P. Scott, Bridgport, Neb., bid only on Sec. No. 10, $38,382; The Denver & Pueblo Constr. Co., Denver, Colo., bid on three sections: Sec. 7, $38,960; Sec. 9, $37,460, and Sec. 10, $33,671; Wood, Bancroft & Doty, David City, Neb., on four sections: Sec. 7, $39,910; Sec. 8, $39,585; Sec. 9, $36,415, and Sec. 10, $32,500; Streeter & Lust Co., Denver, Colo., bid on five sections; Sec. 3, $90,340; Sec. 5, $87,795; Sec. 6, $46,550; Sec. 7, $46,300, and Sec. 8, $47,300; Dead wood Contr. Co., Deadwood, S. D., submitted the lowest bid on Sec. No. 4 as follows: Excav. Class 1, 45,000 cu. yds., 15 cts.; Class 2, 79,000 cu. yds., 29 cts.; Class 3, 100 cu. yds., 35 cts.; Class 4, 100 cu. yds., $1; overhaul, 120,000 cu yds., 2 cts., and 1,000 cu. yds. puddle, 50 cts. It also bid on Sec. No. 3, $83,725. Jas. O'Connor, Morgantown, Ind., submitted the lowest bid on Sec. No. 8 as follows: Excav. Class 1, 295,000 cu. yds., 12 cts.; Class 2, 100 cu. yds., 35 cts.; Class 3, 100 cu. yds., 45 cts.; Class 4, 100 cu. yds., 80 cts.; overhaul, 140,000 cu. yds., 1 ct., and puddle, 1,000 cu. yds., 60 cts.; total, $37,560. He also bid on Sec. 7, $37,960; Sec. 9, $35,060, and Sec. 10, $31,270; Keltic Contr. Co., Joliet, Ill., bid on six sections as follows: Sec. 5, $97,175; Sec. 6, $52,115; Sec. 7, $51,915; Sec. 8, $51,315; Sec. 9, $49,145, and Sec. 10, $43,975. The other bids received for this work are as follows: (*a*) Orman & Crook, Pueblo, Colo.; (*b*) Griffith & McDermott, Merchants' Loan & Trust Bldg., Chicago, Ill.; (*c*) Robinson & Maney, Chemical Bldg., St. Louis, Mo.; (*d*) Kilpatrick Bros. & Collins Contr. Co., Beatrice, Neb.; (*e*) The Burke Const. Co., St. Louis, Mo. (2 bids) *e* 1 and *e* 2; (*f*) D. J. Burke, Guernsey, Wyo.; (*g*) W. C. Bradbury, Railroad Bldg., Denver, Colo.

	a	*b*	*c*	*d*	*e*1	*e*2	*f*	*g*
Sec. No. 1.								
Excav., 260,000 cu. yds.	$0.13¼	$0.15	$0.1199	$0.13¾	$0.154	$0.15	$0.22	$0.15½
Excav., 10,000 cu. yds.	.40	.50	.60	.37	.42	.41	.70	.58
Excav., 100 cu. yds.	.35	.35	.75	.47	.53	.55	.38	.58
Excav., 1,500 cu. yds.	.77	.65	.80	.67	.85	1.00	.85	.90
Overhaul, 140,000 cu. yds.	.01¾	.01¼	.01	.01¼	.01½	.01½	.01½	.01¾
Puddle, 1,000 cu. yds.	.40	.75	.75	.57	.45	.50	.35	.30
Total	$42,490	$47,510	$40,599	$42,822	$48,118	$47,255	$67,963	$50,258
Sec. No. 2.								
Excav., 330,000 cu. yds.	$0.12¾	$0.12	$0.1199	$0.13¾	$0.154	$0.15	$0.14½	$0.15½
Excav., 100 cu. yds.	.46	.50	.60	.37	.42	.41	.65	.58
Excav., 100 cu. yds.	.35	.35	.75	.47	.53	.55	.35	.58
Excav., 100 cu. yds.	.72	.60	.80	.67	.85	1.00	.85	.90
Overhaul, 180,000 cu. yds.	.01¾	.01¼	.01	.01¼	.01½	.01½	.01½	.01¾
Puddle, 1,000 cu. yds.	.40	.75	.75	.57	.45	.50	.40	.30
Total	$45,772	$42,745	$42,332	$48,346	$54,150	$52,896	$51,135	$54,806
Sec. No. 3.								
Excav., 280,000 cu. yds.	$0.13½	$0.12½	$0.1199	$0.13¾	$0.154	$0.145	$0.15	$0.15½
Excav., 27,00 cu. yds.	.39	.50	.60	.37	.42	.39	.75	.58
Excav., 100 cu. yds.	.35	.35	.70	.47	.53	.55	.35	.58
Excav., 38,000 cu. yds.	.72	.70	.75	.67	.85	.85	.88	.90
Overhaul, 180,000 cu. yds.	.01¾	.01¼	.01	.01¼	.01½	.01½	.01½	.01¾
Puddle, 1,000 cu. yds.	.40	.75	.75	.57	.45	.50	.50	.30
Total	$79,275	$78,135	$80,892	$76,817	$89,963	$86,685	$98,925	$96,768
Sec. No. 4.								
Excav., 45,000 cu. yds.	,$0.14	$0.15	$0.1199	$0.13¾	$0.154	$0.175	$0.20	$0.15½
Excav., 79,000 cu. yds.	.39	.50	.60	.37	.42	.43	.75	.58
Excav., 100 cu. yds.	.35	.35	.75	.47	.53	.55	.35	.58
Excav., 100 cu. yds.	.72	.60	.80	.67	.85	1.00	.85	.90
Overhaul, 120,000 cu. yds.	.01¾	.01¼	.01	.01¼	.01½	.01½	.02	.01¾
Puddle, 1,000 cu. yds.	.40	.75	.75	.57	.45	.50	.55	.30
Total	$39,717	$48,595	$54,900	$37,601	$42,498	$44,300	$71,320	$55,343
Sec. No. 5.								
Excav., 346,000 cu. yds.	$0.14	$0.15	$0.18	$0.13¾	$0.154	$0.21	$0.185	$0.15½
Excav., 26,000 cu. yds.	.40	.50	.60	.37	.42	.45	.75	.58
Excav., 100 cu. yds.	.35	.35	.75	.47	.53	.55	.35	.58
Excav., 100 cu. yds.	.72	.60	.80	.67	.85	1.00	.85	.90
Overhaul, 670,000 cu. yds.	.02	.01¼	.01½	.01¼	.01½	.01½	.02	.01¾
Puddle, 10,000 cu. yds.	.43	.75	.75	.57	.45	.40	.65	.30
Total	†$76,647	$80,870	$95,585	$71,384	$78,892	$98,565	$103,530	$83,583
Sec. No. 6.								
Excav., 300,000 cu. yds.	$0.12	$0.117	$0.1099	$0.13¾	$0.154	$0.14	$0.14½	$0.15½
Excav., 100 cu. yds.	.46	.50	.60	.37	.42	.45	.75	.58
Excav., 100 cu. yds.	.35	.35	.75	.47	.53	.55	.35	.58
Excav., 100 cu. yds.	.72	.60	.80	.67	.85	1.00	.80	.90
Overhaul, 140,000 cu. yds.	.01¾	.01¼	.01	.01¼	.01½	.01½	.01½	.01¾
Puddle, 1,000 cu. yds.	.40	.75	.75	.57	.45	.50	.75	.30
Total	$38,997	$37,745	$35,335	$43,721	$48,930	$44,800	$46,540	$49,456
Sec. No. 7.								
Excav., 300,000 cu. yds.	$0.12	$0.117	$0.1099	$0.13¾	$0.154	$0.145	$0.14½	$0.15½
Excav., 100 cu. yds.	.40	.50	.60	.37	.42	.45	.75	.58
Excav., 100 cu. yds.	.35	.35	.75	.47	.53	.55	.35	.58
Excav., 100 cu. yds.	.72	.60	.80	.67	.85	1.00	.80	.90
Overhaul, 120,000 cu. yds.	.01¾	.01¼	.01	.01¼	.01½	.01½	.01½	.01¾
Puddle, 1,000 cu. yds.	.40	.75	.75	.57	.45	.50	100	.30
Total	$38,647	$37,495	$35,135	$43,471	$48,630	$46,000	$46,490	$49,106
Sec. No. 8.								
Excav., 295,000 cu. yds.	$0.12½	$0.13	$0.1199	$0.13¾	$0.154	$0.195	$0.16	$0.15½
Excav., 100 cu. yds.	.40	.50	.60	.37	.42	.45	.65	.58
Excav., 100 cu. yds.	.35	.35	.75	.47	.53	.55	.35	.58
Excav., 100 cu. yds.	.72	.60	.80	.67	.85	1.00	.85	.90
Overhaul, 140,000 cu. yds.	.01¾	.01¼	.01	.01¼	.01½	.01½	.01½	.01¾
Puddle, 1,000 cu. yds.	.40	.75	.75	.57	.45	.50	1.25	.30
Total	$39,872	$40,995	$37,735	$43,033	$48,160	$60,325	$50,775	$48,681
Sec. No. 9.								
Excav., 282,000 cu. yds.	$0.12½	$0.117	$10.99	$0.13¾	$0.154	$0.14	$0.14½	$0.15½
Excav., 100 cu. yds.	.40	.50	.60	.37	.42	.45	.75	.58
Excav., 100 cu. yds.	.35	.35	.75	.47	.53	.55	.35	.58
Excav., 100 cu. yds.	.72	.60	.80	.67	.85	1.00	.80	.90
Overhaul, 131,000 cu. yds.	.01¾	.01¼	.01	.01¼	.01½	.01½	.02	.01¾
Puddle, 1,000 cu. yds.	.40	.75	.75	.57	.45	.40	1.25	.30
Total	$38,089	$35,526	$33,267	$41,133	$46,023	$42,095	$44,950	$46,508
Sec. No. 10.								
Excav., 250,000 cu. yds.	$0.12½	$0.117	$0.1099	$0.13¾	$0.154	$0.14	$0.15	$0.15½
Excav., 100 cu. yds.	.40	.50	.60	.37	.42	.45	.75	.58
Excav., 100 cu. yds.	.35	.35	.75	.47	.53	.55	.38	.58
Excav., 100 cu. yds.	.72	.60	.80	.67	.85	1.00	1.00	.90
Overhaul, 126,000 cu. yds.	.01¾	.01¼	.01	.01¼	.01½	.01½	.01¾	.01¾
Puddle, 1,000 cu. yds.	.40	.75	.75	.57	.45	.40	1.50	.30
Total	$34,002	$31,720	$29,700	$36,671	$41,020	$37,490	$41,418	$41,461
Grand total	$473,508	$481,336	$485,481	$485,000	$546,384	$560,361	$623,046	$575,970

†Lowest bidder.

Charleston, S. C.—Bids will be received until June 24 by Mordecai T. Eradicott, Ch. Bureau Yards and Docks, Navy Dept., Washington, D. C., for an electric freight elevator for Bldg. No. 13, Navy Yard, Charleston.

Bids are wanted June 26 for dredging canal bet. South Edisto and Ashepoo Rivers, S. C., as advertised in The Engineering Record.

Memphis, Tenn.—Bids will received until June 12 by W. F. Gill, Comr. 20 S. Front St. for $100,000 Shelby County emergency levee bonds.

Chattanooga, Tenn.—See "Sewerage and Sewage Disposal."

Galveston, Tex.—Bids are wanted June 28 for jetty work at Galveston, mouth of Brazos River and Aransas Pass, as advertised in The Engineering Record.

Ft. Mifflin, Pa.—Bids will be received June 20 at the Bureau Supplies and Accounts, Navy Dept., Washington, D. C., for constructing a sea wall about 575 ft. in length at the naval magazine, Ft. Mifflin; H. T. B. Harris, Paymaster-Gen., U. S. N.

Norfolk, Va.—Press reports state that bids will shortly be asked for the subsurface construction at the site of the Jamestown Exposition; also for water works and sewerage system.

National Soldiers' Home, Va.—Bids will be received June 15 by B. A. Beesoon, Treas., N. H. D. V. S., for constructing about 850 ft. sea wall; also June 22 for renewing and covering steam pipes.

Seattle, Wash.—Bids will be received June 16 by Maj. John Millis, Corps Engr., U. S. A., for dredging Whatcom (Bellingham) Harbor, Wash.

**Wheeling, W. Va.*—J. A. Swingle & Co., of Zanesville, O., have secured the contract for building a concrete retaining wall near Thompson's, on the National Road (bids opened by Co. Comrs. May 18), at the following bid: 1,380 cu. yds. earth excav., 40 cts; 1,200 cu. yds. fill, 25 cts; 770 cu. yds. concrete foundation, $3.50; 652 cu. yds, concrete main wall, $3.70, and 210 cu. yds. re-enforcing wall, $3.95; 178 lin. ft. coping, $1; replacing old coping, 200 lin. ft., 25 cts., and pointing face of old wall, 3,800 sq. ft., 15 cts.; total, $7,587. Herman L. Arbenz, Co. Engr.

Guantanamo, Cuba.—It is stated that bids will be received until June 13 by the Bureau of Supplies & Accounts, Washington, D. C., for furnishing at naval station, Guantanamo, 2 locomotives and 16 six-yard dump cars. H. T. B. Harris, Paymaster Gen., U. S. N.

PROPOSALS OPEN

For Proposals see pages 78, 79, 80, 81, 84, 85, 86, and 87.

WATER WORKS.

Bids Close.			See Eng. Record.
Jun.	6.	Tunnel, etc., Toronto, Ont. Adv. May 6 to 20.	May 3
Jun.	6.	System, Northfield, Vt. Adv. May 20.	May 20
Jun.	6.	Dams, Southbridge, Mass.	May 27
Jun.	6.	Tower, etc., Scanlon, Minn.	Jun. 3
Jun.	7.	Supplies, Brooklyn, N. Y.	May 27
Jun.	7.	System, Vineland, N. J. Adv. May 27, Jun. 3.	May 27
Jun.	7.	Pipe laying, Calgary, Alta, Can.	Jun. 3
Jun.	7.	Laying pipe, Cheviot, O.	Jun. 3
Jun.	8	Franchise, Ventura, Cal.	May 6
Jun.	8.	Irrig. system, Riverside, Cal.	May 27
Jun.	8.	Supplies, Saginaw, Mich.	Jun. 3
Jun.	8.	Pipe, etc., Newark, N. J. Adv. Jun. 3.	Jun. 3
Jun.	10.	Pipe, Washington, D. C.	May 27
Jun.	10.	Conduit, Dallas, Tex.	May 27
Jun.	10.	Irrig. work, Montpelier, Idaho Adv. May 27, Jun. 3.	May 27
Jun.	12.	Pipe, Whittier, Cal. Adv. Apr. 22 to May 20.	May 13
Jun.	12.	Well, Whittier, Cal. Adv. May 13.	May 13
June	12.	Pump, etc., Whittier, Cal. Adv. May 13.	May 13
Jun.	12.	Intake pipe, Oshawa, Ont.	Jun. 3
Jun.	13.	Laying pipe, etc., Cincinnati, O. (2 prop.). Adv. May 20 to Jun. 3	May 20
Jun.	14.	Well, Ft. Caswell, N. C. Adv. May 20 to Jun. 3.	May 20
Jun.	15.	Canal, etc., Minidoka, Idaho Adv. Apr. 29 to May 27.	Apr. 22
Jun.	15.	Dam, etc., Casper, Wyo. Adv. Apr. 29 to May 20.	Apr. 29
Jun.	15.	Controlling works, etc., Tahoe, Cal. Adv. May 6 to 27.	May 6
Jun.	15.	Purification wks., etc., Columbus, O. Adv. May 13 to Jun. 3.	May 13
Jun.	15.	Well, etc., Waco, Tex.	Jun. 3
Jun.	15.	Gate Valves, Chicago, Ill.	Jun. 3
Jun.	15.	Bolivar, Tenn.	Jun. 3
Jun.	15.	Laying pipe, etc., Oswego, N. Y. Adv. June 3.	Jun. 3
Jun.	15.	Water works, Kimball, S. D.	Jun. 3
Jun.	15.	Remov. of crib, Cleveland, O. Adv. June 3.	Jun. 3
Jun.	15.	Mains, Ft. Wood, N. Y. H., N. Y. Adv. June 3.	Jun. 3
Jun.	19.	Purchase of engines, etc., Cleveland, O. Adv. May 20.	May 20
Jun.	19.	Pipe, etc., Winnipeg, Man. Adv. June 3.	Jun. 3
Jun.	22.	Alma, Neb. Adv. May 27, Jun. 3	May 27
Jun.	24.	Reservoir, Guantanamo, Cuba.	May 20
Jun.	26.	Taking down stand pipe, etc., Sherman, Tex. Adv. Jun. 3	Jun. 3
Jun.	27.	Pipe laying, Cincinnati, O.	Jun. 3
Jun.	28.	Irrig. work, Billings, Mont. Adv. May 6 to Jun. 3.	May 6
Jun.	28.	Pump sta., etc., Huntley, Mont. Adv. May 6 to Jun. 3.	May 6
Jun.	30.	Pumps, etc., Toledo, O. Adv. June 3.	Jun. 3
Jun.	—.	Prescott, Wash.	Apr. 1
Jun.	—.	Alma, Wash.	Apr. 22
Jun.	—.	Pumps, etc., Richland, Ga.	Apr. 22
Jun.	—.	Pipe, etc., Thibodaux, La.	Apr. 22
Jul.	1.	Water works, Winside, Neb.	Jun. 3
Jul.	3.	Reservoir, Winnipeg, Man. Adv. June 3.	Jun. 3
Jul.	17.	Bishopville, S. C. Adv. June 3.	Jun. 3

**Items marked thus give the names of parties awarded contracts.*

SEWERAGE AND SEWAGE DISPOSAL.

Jun. 6. Rockford, Ill. Adv. May 20 ..... May 20
Jun. 6. Washington, D. C. ..... May 27
Jun. 6 Trenton, N. J. ..... May 27
Jun. 6. Maryville, Mo. ..... May 27
Jun. 6. Allentown, Pa. ..... Jun. 3
Jun. 6. Milwaukee, Wis. ..... Jun. 3
Jun. 6. Sioux City, Ia. ..... Jun. 3
Jun. 6. New Germany, Minn. ..... Jun. 3
Jun. 7. Susquehanna, Pa. ..... May 27
Jun. 7. Gallitzin, Pa. ..... Jun. 3
Jun. 7. Calgary, Alta, Can. ..... Jun. 3
Jun. 7. Marion, O. ..... Jun. 3
Jun. 8. Saginaw, Mich. ..... Jun. 3
Jun. 9. Cincinnati, O. ..... May 20
Jun. 9. Meridian, Miss. ..... May 27
Jun. 9. Bloomington, Ill. ..... Jun. 3
Jun. 10. Xenia, O. ..... May 27
Adv. May 27, Jun. 3.
Jun. 10. Washington, D. C. ..... May 27
Jun. 12. Cambridge, O. ..... May 27
Adv. May 27.
Jun. 12. Long Island City, L. I., N. Y. ..... Jun. 3
Jun. 12. Indianapolis, Ind. ..... Jun. 3
Jun. 13. Milton, Pa. ..... May 27
Jun. 15. Cincinnati, O. ..... May 27
Jun. 17. Oconto, Wis. ..... May 20
Adv. May 20, 27.
Jun. 20. Chicago, Ill. Adv. May 27, Jun. 3 .. May 27
Jun. 20. Waterbury, Conn. ..... May 20
Adv. May 20 to Jun. 3.
Jun. 21. Greensburg, Ind. ..... Jun. 3
Jun. 22. Janesville, Wis. ..... Jun. 3
Jun. 22. Galveston, Tex. ..... Jun. 3
Adv. June 3.
Jun. 27. Cleveland Heights, O. ..... Jun. 3
Jun. —. Sacramento, Cal. ..... May 13
Jul. 1. Morgantown, N. C. ..... Jun. 3

BRIDGES.

Jun. 6. Dayton, O. ..... May 13
Adv. May 13 to Jun. 3.
Jun. 6. Marion, O. ..... May 20
Jun. 6. Perth, Ont. ..... May 20
Jun. 6. Plymouth, Ind. ..... May 27
Jun. 6. Mitchell, Ont. ..... May 27
Jun. 6. Delaware, O. ..... Jun. 3
Jun. 6. Berlin, Ont. ..... Jun. 3
Jun. 7. Lafayette, Ind. ..... May 20
Jun. 7. Iola, Kan. ..... May 27
Jun. 8. Towson, Md. ..... May 27
Jun. 10. Rockville, Ind. ..... May 20
Jun. 10. Cleveland, O. ..... May 27
Jun. 10. Lakota, N. D. ..... Jun. 3
Jun. 13. Miniota, Man. ..... May 27
Jun. 13. Kingston, Ga. ..... May 27
Jun. 13. Berwick, Pa. ..... Jun. 3
Jun. 15. Ainsworth, Neb. ..... May 20
Jun. 15. Elmira, N. Y. ..... Jun. 3
Adv. June 3.
Jun. 15. Zanesville, O. ..... Jun. 3
Jun. 15. Indianapolis, Ind. ..... Jun. 3
Jun. 15. Charleston, W. Va. ..... Jun. 3
Adv. June 3.
Jun. 17. Chesley, Ont. ..... May 20
Jun. 20. Cadillac, Mich. ..... May 13
Adv. May 13 to 27.
Jun. 20. Fargo, N. D. ..... Jun. 3
Jun. 20. O'Neil, Neb. ..... Jun. 3
Jun. 20. Tacoma, Wash. ..... Jun. 3
Jun. 24. Ada, Mich. ..... Jun. 3
Adv. June 3.
Jun. 28. Tiverton, R. I. ..... Jun. 3
Adv. June 3.
Jul. 5. Tillamook, Ore. ..... May 27
Jul. 5. Vale, Ore ..... Jun. 3
Jul. 6. Redding, Cal. ..... May 27
Jul. 6. Lawrenceville, Ga. ..... Jun. 3

PAVING AND ROADMAKING.

Jun. 6. Waterbury, Conn. ..... May 13
Jun. 6. Indianapolis, Ind. ..... May 13
Jun. 6. Amsterdam, N. Y. ..... May 13
Jun. 6. Washington, D. C. ..... May 27
Jun. 6. Brownstown, Ind. ..... May 27
Jun. 6. Tamaqua, Pa. ..... Jun. 3
Adv. June 3.
Jun. 6. Elkton, Md. ..... Jun. 3
Jun. 6. Butler, Pa. ..... Jun. 3
Jun. 6. Troy, N. Y. ..... Jun. 3
Jun. 7. Flemington, N. J. .. .. May 13
Adv. May 13 to 27.
Jun. 7. East Cleveland, O. ..... May 20
Jun. 7. Providence, R. I. ..... May 27
Jun. 7. Cincinnati, O. ..... Jun. 3
Jun. 7. Calgary, Alta, Can. ..... Jun. 3
Jun. 8. Cincinnati, O. ..... May 20
Jun. 8. Towson, Md. ..... May 27
Jun. 8. Hartford City, Ind. ..... Jun. 3
Jun. 8. Saginaw, Mich. ..... Jun. 3
Jun. 10. Wyoming, O. ..... May 20
Jun. 10. Cleveland, O. ..... May 27
Jun. 10. Washington, D. C. ..... May 27
Jun. 10. Bloomfield, Ind. ..... Jun. 3
Jun. 12. Cincinnati, O. ..... May 27
Jun. 12. Houghton, Mich. ..... May 27
Jun. 12. Indianapolis, Ind. ..... Jun. 3
Jun. 12. Long Island City, L. I., N. Y. ..... Jun. 3
Jun. 12. Frederick, Md. ..... Jun. 3
Jun. 13. Painesville, O. ..... Jun. 3
Jun. 14. Freehold, N. J. ..... May 27
Jun. 14. Ft. Strong, Mass. ..... May 27
Jun. 14. Brooklyn, N. Y. ..... May 27
Jun. 14. Hoboken, N. J. ..... Jun. 3
Jun. 15. Cincinnati, O. ..... May 27
Jun. 15. Corning, N. Y. ..... May 27
Adv. May 27 to Jun. 3.
Jun. 16. Cincinnati, O. ..... May 20
Jun. 16. Terrace Park, O. ..... Jun. 3
Jun. 16. Lisbon, O. ..... Jun. 3
Jun. 17. La Crosse, Wis. ..... May 27
Jun. 19. New Orleans, La. ..... May 13
Adv. May 13 to Jun. 3.
Jun. 19. Morristown, N. J. ..... May 27
Adv. May 27, Jun. 3.
Jun. 19. Marietta, Wis. ..... Jun. 3
Jun. 22. Delaware, O. ..... Jun. 3
Jun. 23. Steubenville, O. ..... Jun. 3
Jun. 23. Glendale, O. ..... Jun. 3
Jun. 26. Cincinnati, O. ..... Jun. 3
Jun. —. Council Bluffs, Ia. ..... May 20
Aug. 1. Belvidere, Ill. ..... May 20

POWER, GAS AND ELECTRICITY.

Jun. 6. Sebastapol, Cal. ..... Apr. 22
Jun. 6. Shelbyville, Tenn. ..... May 13
Jun. 6. N. Tonawanda, N. Y. ..... May 20
Jun. 6. Washington, D. C. ..... May 27
Jun. 7. Baltimore, Md. ..... Jun. 3
Jun. 8. Newport, Ky. ..... Apr. 29
Jun. 8. Wilmington, N. C. ..... May 20
Adv. May 20, 27.
Jun. 10. Norfolk, Va. ..... May 20
Jun. 10. Washington, D. C. ..... May 20
Adv. May 20, 27.
Jun. 12. Winnipeg, Man. ..... May 20
Adv. May 20, 27.
Jun. 12. Brooklyn, N. Y. ..... Jun. 3
Jun. 14. Washington, D. C. ..... Jun. 3
Jun. 14. Kearny, N. J. ..... Jun. 3
Jun. 15. Selingsgrove, Pa. ..... May 27
Jun. 15. Bolivar, Tenn. ..... Jun. 3
Jun. 16. Grand Haven, Mich. ..... May 27
Adv. May 27, Jun. 3.
Jun. 17. Ellis Island, N. Y. Harbor ..... Jun. 3
Jun. 19. Ft. Warren, Mass. ..... Jun. 3
Jun. 20. Dunn, N. C. ..... Jun. 3
Jun. 20. Washington, D. C. ..... Jun. 3
Jun. 22. Alma, Neb. Adv. May 27 to Jun. 3 .. May 27
Jul. 7. Durant, Miss. ..... Jun. 3

BUILDINGS.

Jun. 6. P. O. Bldg., Rockhill, S. C. ..... Apr. 29
Jun. 6. School, Wellsville, O. ..... May 20
Jun. 6. School, Orange, N. J. ..... May 27
Jun. 6. School, Galena, Ill. ..... May 27
Jun. 6. School, Stillwater, Okla. Ter. ..... Jun. 3
Jun. 6. Hospital, Trenton, N. J. ..... Jun. 3
Jun. 6. Court House, North Hampton, Ia. ... Jun. 3
Jun. 7. School Improv., Winona, Minn. ..... Jun. 3
Jun. 7. P. O. bldg., Reno, Nev. ..... May 6
Jun. 7. Pub. buildings, Honolulu, H. I. ..... May 13
Jun. 7. Magazine, etc., Ft. Mifflin, Pa. ..... May 20
Jun. 7. Hospital, Brooklyn, N. Y. ..... May 27
Jun. 7. Hospital, Jackson, Miss. ..... May 27
Jun. 7. Engine house, Kansas City, Mo. ..... May 27
Jun. 7. Elks' Temple, Manistee, Mich. ..... Jun. 3
Jun. 7. School, Boston, Mass. ..... Jun. 3
Jun. 7. Church, Valley City, N. D. ..... Jun. 3
Jun. 8. P.-O. bldg., Amesbury, Mass. ..... May 6
Adv. May 20, 27.
Jun. 8. School, Hilliards, O. ..... May 20
Jun. 8. Post. Bldgs., Ft. Totten, N. Y. ..... May 20
Adv. May 20, Jun. 3.
Jun. 8. Library, Union, N. J. ..... May 20
Jun. 8. Pub. Bldg., Ft. Riley, Kan. ..... May 27
Jun. 8. School, Riverside, Cal. ..... May 27
Jun. 8. Pub. bldg., Marietta, O. ..... May 27
Jun. 8. Hospital, Ft. Screven, Ga. ..... Jun. 3
Jun. 9. Htg. School, Wyandotte, Mich. ..... Jun. 3
Jun. 9. Pub. Bldgs., Washington, D. C. ..... May 27
Jun. 9. Pub. bldg., Ft. Scott, Kan. ..... May 27
Jun. 9. Hospital, Woodstock, Ont. ..... Jun. 3
Jun. 10. Schools, Alaska ..... May 6
Jun. 10. Court house, Plaquemine, La. ..... May 6
Adv. May 6 to Jun. 3.
Jun. 10. Bus. Bldg., Baton Rouge, La. ..... May 27
Jun. 10. School, St. Wendells, Ind. ..... May 27
Jun. 10. School, Piqua, O. ..... May 27
Jun. 10. Post Bldg., Ft. Wadsworth, N. Y. ... Jun. 3
Jun. 10. College, Amherst, Mass. ..... Jun. 3
Jun. 10. Hospital, Norristown, Pa. ..... Jun. 3
Jun. 10. School, Marianna, Ark. ..... Jun. 3
Jun. 12. Capitol plans, Boise, Idaho ..... Apr. 22
Jun. 12. School, Cleveland, O. ..... May 20
Jun. 12. School, Baton Rouge, La. ..... May 27
Jun. 12. Jail, etc., Newburgh, N. Y. ..... May 27
Jun. 12. Schools, New York, N. Y. ..... May 27
Jun. 12. School, Wakonda, N. D. ..... Jun. 3
Jun. 12. Court House plans, Fairmont, Minn.. Jun. 3
Jun. 12. School, Ann Arbor, Mich. ..... Jun. 3
Jun. 12. School, Ft. Wayne, Ind. ..... Jun. 3
Jun. 12. School, Cincinnati, O. ..... Jun. 3
Jun. 12. Htg. school, Watertown, N. Y. ..... Jun. 3
Jun. 12. Schools, New York, N. Y. ..... Jun. 3
Jun. 13. School, Indianapolis, Ind. ..... Jun. 3
Jun. 14. Pub. Bldgs., Lawrence, Ind. ..... May 20
Adv. May 20 to Jun. 3.
Jun. 14. Pub. Bldg., Washington, D. C. ..... Jun. 3
Jun. 14. Hospital, Raleigh, N. C. ..... Jun. 3
Jun. 15. Court House plans, New Orleans, La.. Feb. 25
Jun. 15. Synagogue plans, Houston, Tex. ..... Apr. 15
Jun. 15. Court House plans, New Orleans, La. Apr. 22
Jun. 15. Pub. bldg., Honolulu, H. I. ..... Apr. 29
Jun. 15. Window screens, etc., at Post, Key West Barracks, Fla. ..... May 20
Adv. May 20 to Jun. 3.
Jun. 15. Boat House, Key West Barracks, Fla.. May 20
Adv. May 20 to Jun. 3.
Jun. 15. Post bldg., Oswego, N. Y. ..... May 27
Adv. May 27 to Jun. 3.
Jun. 15. Post bldg., Ft. Wright, Wash. ..... May 27
Jun. 15. Hospital, Patton, Cal. ..... May 27
Jun. 15. School, Cleveland, O. ..... May 27
Jun. 15. Barracks, Ft. Niobrara, Mont. ..... Jun. 3
Jun. 15. Post Bldgs., Ft. Mackenzie, Wyo. ..... Jun. 3
Adv. June 3.
Jun. 15. Post Bldgs., Ft. Des Moines, Ia. ..... Jun. 3
Adv. June 3.
Jun. 15. Pub. Bldg., New York, N. Y. ..... Jun. 3
Jun. 16. Post Bldgs., Ft. Lincoln, N. D. ..... Jun. 3
Jun. 16. Pub. Bldg., Ft. Hancock, N. J. (2 prop.). Adv. May 20 to Jun. 3 ..... May 20
Jun. 16. Pub. Bldg., Towson, Md. ..... Jun. 3
Jun. 17. School, Toledo, O. ..... May 27
Jun. 19. P. O. Bldg., Atlantic, Ia. ..... May 20
Jun. 19. School, Grand Rapids, Mich. ..... May 20
Jun. 19. Light House, Baltimore, Md. ..... May 27
Adv. May 27.
Jun. 19. School, St. Johns, O. ..... May 27
Jun. 19. School, New York, N. Y. ..... Jun. 3
Jun. 20. P. O. Bldg., Colorado Springs, Colo.. May 20
Adv. May 13, 20.
Jun. 20. School, Port Arthur, Tex. ..... May 27
Jun. 21. P. O. Bldg., Winston, N. C. ..... May 20
Jun. 23. P. O. bldg., Vancouver, B. C. ..... May 27
Jun. 23. Hospital, Dayton, O. ..... Jun. 3
Jun. 24. Post Bldgs., Ft. Monroe, Va. ..... Jun. 3
Jun. 24. School, Bedford, O. ..... Jun. 3
Jun. 25. Court House, Lake Village, Ark. ..... Jun. 3
Jun. 26. P. O. Bldg., Niagara Falls, N. Y. ..... May 27
Jun. 26. School, Poplar, Mont. ..... Jun. 3
Jun. 26. School, Des Moines, Ia. ..... Jun. 3
Jun. 27. Library, Cincinnati, O. ..... Jun. 3
Jun. 28. P. O. Bldg., Westchester, Pa. ..... May 27
Jun. 29. Hospital, Washington, D. C. ..... Jun. 3
Jun. 30. Lodge, Diamond, Ind. ..... Jun. 3
Jun. —. School plans, Stillwater, Okla. Ter. ..... May 20
Jul 1. Pub. Bldg., Washington, D. C. ..... May 27
Adv. May 27 to Jun. 3.
Jul. 1. Pub. Bldg., Baltimore, Md. ..... May 20
Jul. 1. Court House, Wallace, Idaho ..... Jun. 3
Jul. 5. Court House plans, Montgomery, Ala.. May 27
Jul. 6. Hospital, Dunlaps, Ia. ..... Jun. 3
Jul. 20. Custom House, San Francisco, Cal.. Jun. 3
Jul. 30. Court House improv., Leesville, La. .. May 13
Aug. 1. Y. M. C. A. Bldg., Spokane, Wash. .. Apr. 29

MISCELLANEOUS.

Jun. 6. Channel excav., Ogdensburg, N. Y... May 13
Adv. May 13 to Jun. 3.
Jun. 6. Supplies, Washington, D. C. ..... May 27
Jun. 6. Supplies, Washington, D. C. ..... May 13
Jun. 7. Rostrum, Culpeper, Va. ..... May 13
Adv. May 13 to Jun. 3.
Jun. 8. Dikes, Augusta, Ga. ..... May 6
Adv. May 6 to 27.
Jun. 8. Jetty work, Cleveland, O. ..... May 13
Adv. May 13, 20.
Jun. 8. Supplies, Wilmington, N. C. ..... May 20
Jun. 8. Canal, Onawa, Iowa ..... May 20
Adv. May 20, 27.
Jun. 8. Incinerator, New York, N. Y. ..... Jun. 3
Jun. 8. Ditch, Papillion, O. ..... Jun. 3
Jun. 9. Pump Mchry., etc. in P. O. Bldg. Newport News, Va. Adv. May 20, 27. May 20
Jun. 9. Wharf, New Carlisle, Que. ..... May 27
Jun. 9. Piers, New York, N. Y. ..... Jun. 3
Jun. 10. Iron wk. for lock, Little Rock, Ark.. May 13
Adv. May 13 to Jun. 3.
Jun. 10. Pier, Detroit, Mich. ..... May 13
Adv. May 13 to Jun. 3.
Jun. 10. Dredging, Wilmington, Del. ..... May 20
Jun. 10. Cement for lock, Little Rock, Ark. ..... May 13
Adv. May 13 to Jun. 3.
Jun. 10. Crusher, Fall River, Mass. ..... Jun. 3
Jun 12. Ditch work, Geneseo, Ill. ..... May 13
Adv. May 13 to Jun. 3.
Jun. 12. Dredging, Lynn, Mass. ..... May 13
Adv. May 13 to Jun. 3.
Jun. 12. Terrace wall, Holyoke, Mass. ..... May 27
Adv. May 27, Jun. 3.
Jun. 12. Belting, etc., Panama ..... Jun. 3
Jun. 13. Pier, Gallipolis, O. ..... May 20
Jun. 13. Pier, Maysville, Ky. ..... May 20
Jun. 13. Dam, Iowa City, Ia. ..... May 27
Adv. May 27, Jun. 3.
Jun. 13. Supplies, Pensacola, Fla. ..... Jun. 3
Jun. 13. Cars, Guantanamo, Cuba ..... Jun. 3
Jun. 13. Cable, etc., Washington, D. C. ..... Jun. 3
Jun. 14. Bldg. Material, etc., West Point, N.Y.. May 20
Adv. May 20 to Jun. 3.
Jun. 14. Rubblestone, Boston, Mass. ..... May 20
Adv. May 20 to Jun. 3.
Jun. 14. Tower, Philadelphia, Pa. ..... May 20
Jun. 14. Elevator, Savannah, Ga. ..... Jun. 3
Jun. 15. Pole and telephone line, Minidoka, Idaho. Adv. Apr. 22 to May 27.... Apr. 22
Jun. 15. Wharf, etc., Honolulu ..... Apr. 29
Jun. 15. Trestles, etc., Louisville, Ky. ..... May 20
Adv. May 20 to Jun. 3.
Jun. 15. Excav., etc., Panama ..... May 20
Adv. May 20 to Jun. 3.
Jun. 15. Dredging, Mobile, Ala. ..... May 20
Adv. May 20 to Jun. 3.
Jun. 15. Remov. wreck, Jacksonville, Fla. ..... May 20
Adv. May 20 to Jun. 3.
Jun. 15. Jetty work, Sabine Pass, Tex. ..... May 27
Adv. May 27, Jun. 3.
Jun. 15. Ditches, St. Paul, Minn. ..... Jun. 3
Jun. 15. Sea Wall, National Soldiers' Home, Va. Jun. 3
Jun. 16. Dredging, Seattle, Wash. ..... Jun. 3
Jun. 19. Dredging, Norfolk, Va. ..... May 27
Adv. May 27, Jun. 3.
Jun. 19. Dredging, Wilmington, Del. ..... May 20
Adv. May 20 to June 3.
Jun. 19. Supplies, Rock Island, Ill. ..... May 27
Jun. 19. Breakwater, Cleveland, O. ..... May 27
Jun. 19. Wharf, Winthrop, Mass. ..... Jun. 3
Jun. 19. Seawall, Ft. Andrews, Peddock's Island, Mass. ..... Jun. 3
Jun. 20. Searchlight outfit, Washington, D. C.. May 20
Adv. May 13 to Jun. 3.
Jun. 20. Dredging, Wilmington, Del. ..... May 27
Adv. May 27, Jun. 3.
Jun. 20. Dredging, Baltimore, Md. ..... May 27
Adv. May 27, Jun. 3.
Jun. 20. Dredging, Detroit, Mich. ..... May 27
Adv. May 27, Jun. 3.
Jun. 20. Elevator, Washington, D. C. ..... May 27
Jun. 20. Levee, Walnut Hill, Ark. ..... May 27
Jun. 20. Sea Wall, Ft. Mifflin, Pa. ..... Jun. 3
Jun. 20. Stone, etc., Vicksburg, Miss. ..... Jun. 3
Adv. June 3.
Jun. 20. Supplies, Washington, D. C. ..... Jun. 3
Jun. 20. Pier, Cleveland, O. ..... Jun. 3
Jun. 21. Light house supplies, Tompkinsville, S. I., N. Y. Adv. May 27, Jun. 3 .... May 27
Jun. 21. Dredging, Baltimore, Md. ..... May 27
Adv. May 27, Jun. 3.
Jun. 21. Levee work, Hopefield, Ark. ..... May 27
Adv. May 13, 27.
Jun. 21. Dredging, Wilmington, Del. ..... May 27
Jun. 22. Dredging, Detroit, Mich. ..... May 27
Adv. May 27, Jun. 3.
Jun. 22. Sea Wall, Governor's Island, N. Y. H. May 27
Adv. May 27, Jun. 3.
Jun. 22. Extension of Jetty, Portland, Ore. ... Jun. 3
Jun. 22. Renewing steam pipes, National Soldiers' Home, Va. ..... Jun. 3
Jun. 24. El. Ry. franchise, Hollister, Cal. ..... May 20
Jun. 24. Elevator, Charleston, S. C. ..... Jun. 3
Jun. 26. Telephone system, Belle Fourche, S. D. May 27
Adv. May 27, Jun. 3.
Jun. 26. Dredging, Boston, Mass. (2 prop.) ... May 27
Adv. May 27, Jun. 3.
Jun. 26. Dredging, Wilmington, Del. ..... Jun. 3
Adv. June 3.
Jun. 26. Dike, etc., Duluth, Minn. ..... Jun. 3
Adv. June 3.
Jun. 26. Dredging, Boston, Mass. ..... Jun. 3
Jun. 26. Dredging, Charleston, S. C. ..... Jun. 3
Adv. June 3.
Jun. 27. Dredging, Boston, Mass. ..... Jun. 3
Jun. 27. Dredging, Duluth, Minn. ..... Jun. 3
Adv. June 3.
Jun. 28. Jetty Work, Galveston, Tex. ..... Jun. 3
Adv. June 3.
Jun. 30. Dredging, York, Me. ..... Jun. 3
Adv. June 3.
Jun. 30. Dredging, Savannah, Ga. ..... Jun. 3
Adv. June 3.
Jun. —. Subway, Memphis, Tenn. ..... May 13
Jul 1. Municipal St. Ry. system, Chicago, Ill. Apr. 15
Adv. Apr. 15 to May 6.
Jul. 1. Dredge, Chicago, Ill. ..... Jun. 3
Aug. 26. Coal plant, Olongapo, P. I. ..... May 6
Sep. 1. Steel and iron, Sydney, N. S. Wales.. Apr. 8
Adv. Apr. 8, 22, May 6, 20, Jun. 3.
Apr. 2, '06. Harbor Work, Valparaiso, Chili .... Apr. 29